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ABSTRACT

Students enrolled in four classes in mathematics at a predominantly black, urban community college were subjects of a research study designed to identify their attitudes toward mathematics, test these attitudes with various correlates, identify possible factors responsible for developing negative attitudes toward mathematics, and make recommendations for methods of improving attitudes toward mathematics. Statistically significant correlations were found to exist between male/female attitudes toward mathematics. Statistically significant results were also found between attitudes toward mathematics and mathematics anxiety, attitudes toward mathematics and personality, personality characteristics for females, and attitudes toward mathematics and dominance for males. No statistical significance was found between attitudes toward mathematics and mathematics achievement. It can be concluded that: (1) students with negative attitudes toward mathematics possess unique anxieties toward mathematics; (2) females possess more negative attitudes toward mathematics than males; (3) females with negative attitudes toward mathematics (more so than males) possess definite personality characteristics; (4) attitudes toward mathematics do not influence achievement; and (5) attitudes toward mathematics were influenced to a great extent by teacher attitudes. One recommendation offered is that teacher education programs offer courses dealing with attitudes toward subject matter courses. (Author/JN)

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A DETERMINATION OF ATTITUDES TOWARD MATHEMATICS AND AN ANALYSIS OF FACTORS WHICH ARE ASSOCIATED WITH NEGATIVE ATTITUDES TOWARD MATHEMATICS OF STUDENTS AT AN URBAN COMMUNITY COLLEGE: A DESCRIPTIVE STUDY

A Dissertation presented to the Faculty of Heed University in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

by

ROSE MARIE BROWN, B.Ed., M.A.

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DISSERTATION ABSTRACT

A DETERMINATION OF ATTITUDES TOWARD MATHEMATICS AND AN ANALYSIS OF FACTORS WHICH ARE ASSOCIATED WITH NEGATIVE ATTITUDES TOWARD MATHEMATICS OF STUDENTS AT AN URBAN COMMUNITY COLLEGE: A DESCRIPTIVE STUDY

PURPOSE

The purpose of the present study is based on the theory that attitudes play a functional role in the individual's learning processes, i.e., positive attitudes aid in the acquisition and retention of knowledge and negative attitudes hinder the process. Therefore, this study attempts to identify the subjects' attitudes toward mathematics, to test attitudes toward mathematics with various other correlates, to identify possible factors responsible for developing negative attitudes toward mathematics, and to make recommendations for methods of improving attitudes toward mathematics.

METHODOLOGY

Students enrolled in four classes in mathematics at a predominantly

black urban community college were the subjects of the research which was conducted during the fall 1979 semester. All subjects were asked to complete a biodata form, and they were also given five instruments designed to measure the following:

1. Attitude toward mathematics
2. Achievement in mathematics
3. Anxiety toward mathematics
4. Personality characteristics.

Finally, those subjects identified by scores obtained on the instruments measuring attitudes toward mathematics as having negative attitudes toward mathematics were given a personal interview.

All data were analyzed using nonparametric statistical tests. The Kolmogorov-Smirnov test was conducted to determine whether or not the attitudes toward mathematics of females and males were stochastically distributed. The Spearman-rank correlation-coefficient was conducted with attitudes toward mathematics as the moderator variable and each of the following dependent variables:

1. Achievement in mathematics
2. Anxiety toward mathematics
3. Personality characteristics
4. Dominance
5. Femininity

The results of the above correlations together with the information

obtained from the responses from the personal interviews were used to identify some reasons for negative attitudes toward mathematics.

MAJOR FINDINGS

Statistically significant correlations were found to exist between male/female attitudes toward mathematics. Statistically significant results were also found between attitudes toward mathematics and anxiety toward mathematics, attitudes toward mathematics and personality characteristics for females, and attitudes toward mathematics and dominance for males. No statistical significance was found between attitudes toward mathematics and achievement in mathematics.

CONCLUSIONS

It can be concluded that:

1. Community college students with negative attitudes toward mathematics do possess unique anxieties toward mathematics.
2. Community college females do possess more negative attitudes toward mathematics than do males.
3. Community college females with negative attitudes toward mathematics, more so than males, do possess definite personality characteristics.
4. Attitudes toward mathematics do not influence achievement.
5. Attitudes toward mathematics were influenced to a great extent by the attitudes of teachers.

RECOMMENDATIONS

Teachers should be made aware of the impact of their actions and the resultant transferance of attitudes for which they are directly

and indirectly responsible for in their students. This can be accomplished through in service training programs conducted nationally throughout the educational system for both elementary and high school teachers.

Those persons responsible for training teachers should begin to include in the curricula for all perspective teachers required courses dealing with attitudes toward subject matter courses. Perspective teachers should be cognizant of their own attitudes toward the subjects they plan to teach. Teacher training institutions must begin to take the iniative in improving current curricula in order to combat apparent short comings.

Further research can be conducted in the following areas:

1. Additional studies are needed on the effect of attitudes on the acquisition of knowledge of community college students.
2. The curricula of teacher training institutions needs to be examined for relevance in content and design as it attempts to prepare teachers to meet the current and future needs of students.
3. The effects of and need for appraisals of the impact of attitudes of teachers on their students in subject matter areas and the possible need for improvement of same.

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In Memory of My Mother

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CHAPTER I

THE PROBLEM

1.1 Introduction

What is Mathematics? Mathematics is a word that can and does provoke in people an emotional reaction. By definition, mathematics is the group of sciences (including arithmetic, geometry, algebra, calculus) dealing with quantities, magnitudes, and forms as well as their relationships and attributes, by the use of numbers and symbols (Guralnik, 1976). However, a majority of the general public does not view mathematics on the basis of the above definition. People tend to have an emotional reaction where mathematics is concerned.

Mathophobia. Moreoften than not, people --students and non-students, professionals and non-professionals, children, teens and adults-- have expressed an aversion to and avoidance

of mathematics. This reaction has been termed mathophobia by Jerrold Zacharias (Lazarus, 1974). Mitchell Lazarus discusses the term in his article "Mathophobia: Some Personal Speculations", in which he states, "Mathophobia is an irrational and impedetive dread of mathematics" (p.17). Not only is it the dread of mathematics that causes the systematic avoidance of all things mathematical, but also the negative attitude that is the result of this dread.

It would appear that there is no built-in immunity against a person developing mathophobia because it was found that "by the time a student leaves school, the chances are good that he will have acquired mathophobia at one point or another during his education" (Lazarus, 1974, p. 16). This results in mathematics becoming a source of anxieties. It can occur at any age and with varying degrees of intensity. Certainly, the earlier the age that one is affected the more serious will be the crippling effect for it can undoubtly cause one to avoid mathematics and mathematical situations throughout one's lifetime.

Ramifications of Mathophobia. When negativism towards mathematics is viewed with respect to early schooling, career alternatives, and everyday living situations, the problem has

serious ramifications.

The earlier the negative feeling towards mathematics develops, the more devastating the effect on one's future. Suppose it occurs in the primary school years --then the very foundation upon which all future mathematical concepts are to be built will be non-existent or very limited at best and the individual will have difficulty with even minimal mathematical processes. "Current educational practice provides little indication of whether a student really understands mathematics or not. If he does not, and that fact escapes detection, consequent failure and frustration are almost inevitable, and mathophobia is likely to follow" (Lazarus, 1974, p. 19). Thus, the problem is compounded until the point is reached whereby the person knows he is not going to succeed in mathematics so he does not try. Naturally he will not be successful and the endless loop of failure and frustration is begun.

Another ramification of mathophobia is evident in career choice. The choice of a career is based on interests and accessibility depending on sex and race, economic factors with reference to cost of training, time in terms of years necessary for preparation, and job market as far as current

and future demands are concerned. Once these variables have been examined and the final decision has been made, it is unfortunate to say the least that some irrational attitude will cause a change or alteration of one's plans. But this is exactly what is happening on many college campuses.

> The generally high incidence of mathophobia shows up with particular clarity on the college and university campuses, because it is there that many people are brought into forcible contact with relatively advanced mathematics. Especially on the large state campuses, any faculty member who advises students has known several who changed their majors primarily to avoid a mathematics requirement, giving up a preferred career to spare themselves calculus or statistics (Lazarus, 1974, p. 18).

Therefore, it would seem that there is a need for research in order to help identify factors that cause negative attitudes toward mathematics so that the imbalance of career decisions and unequal emphasis on producing majors and occupational choices that have little or no mathematical requirements can be eradicated.

The deliberate avoidance of mathematics becomes even more unfortunate when it is realized that the foundation for expertise in many areas is mathematics, especially the higher earning occupations, e.g. actuary, chemist, computer scientist, dentist, engineer, pharmacist, physician, physi-

cist or pilot to name a few. Entry into any of these areas as college majors require beginning calculus which presupposes four years of high school mathematics. Therefore, taking courses in mathematics is more than a matter of interest, it is a matter of equality (Kaminski, 1976).

And, finally, what aspect of one's life can be considered without some reference to mathematics --from the very simplest taxi fare to the more complex income-tax, long forms? Many tragic situations involving unnecessary bankruptcies have been the result of irrational use of credit buying. Informal discussions in many of the researcher's terminal college classes in mathematics have produced startling information. For instance, a majority of the students confess that they have no idea how to determine the charges incurred from credit buying either long term, as in the purchase of an automobile, or for shorter term purchases such as clothing. Many home owners could not discuss the difference between an eight percent mortgage and a contract purchase of a house that had charges upwards of fifteen percent. Is it any wonder that there are so many boarded up, repossessed homes in some areas? More tragic in these discussions of credit was the fact that many also did not

know how to calculate the amounts that were being earned on savings!

Thus, there are serious and far-reaching ramifications of this mathophobic state that so many people find themselves. Most peoples' lives have been influenced to a greater or less degree by attitudes of negativism towards mathematics. So it becomes important for the youth of the nation and for national security in its purest sense that alternatives be developed to counteract mathophobia for it is unforgiveable to leave untapped or partially developed our most precious natural resource --the human mind.

1.2 Statement of the Problem

Rationale of the Study. Education for everyone during the first sixteen years of life is accepted in the United States as a natural course of events. It therefore becomes apparent that the school system must accept a major part of the responsibility for the development of negative attitudes toward mathematics within the general public. Having aided in the creation of this monster, the educational system must therefore become instrumental in bringing about its demise.

To aid in the process of eliminating negative attitudes toward mathematics in the general public, the following questions are in need of research:

1. Is it possible to identify the causes of these negative feelings towards mathematics --this mathophobia as it were in a majority of the population?
2. Once acquired, are these negative attitudes passed on to succeeding generations by parents?
3. Are they promoted and inadvertently promulgated by the school system?
4. Is the cause for negativism "mathematics itself with its attendant conventions of notation and terminology"? (Lazarus, 1974, p. 21)
5. Does the possession of these attitudes lend itself to immediate identification?
6. Can mathophobia be prevented?
7. Can mathophobia be cured?
8. Why does it occur at different ages in varying degrees of intensity?

Purpose of the Study. The main purpose of this study is to seek answers to the above mentioned questions, i.e., to ascertain some of the sources of negative attitudes toward mathematics as demonstrated by community college students.

The second purpose of this research is to propose

not only preventative programs, but also to make recommendations that will contain curative and lenitive features.

1.3 Hypotheses

This study will test the following hypotheses:

1. Community college students with negative attitudes toward mathematics are lower achievers than those with positive attitudes toward mathematics.
2. Community college students with negative attitudes toward mathematics possess unique mathematical anxieties.
3. Community college females possess a more negative attitude toward mathematics then do males.
4. Community college students with negative attitudes toward mathematics possess definite personality traits different from those with positive attitudes toward mathematics.
5. There are specific factors contributing to the acquisition of negative attitudes toward mathematics of community college students.

1.4 Delimitations of the Study

Sample. The population to be surveyed constitutes students at Kennedy King City College. Kennedy King is one of nine comprehensive (i.e. encompassing transfer and occupational curricula as well as an adult educational program) community colleges in Chicago. It is located on the city's south side in a predominantly black community and the student body is ninety-eight percent black. There

are no residency restrictions and the only requirement for enrollment is that a person be at least seventeen years of age.

The particular students in this study will constitute a preselected sample in that they will be members of four mathematical classes which each student has chosen without prior knowledge of the research that is being conducted. One class is a prerequisite for persons desiring entrance into the nursing program. The second class is mathematics for technicians and the members are those students majoring in automotive technology, air conditioning, electronics, photo offset, and other technical areas. The third class is elementary algebra for students who have never had an algebra course. The fourth class is college algebra with the usual prerequisites. The other three classes do not have prerequisites.

Research Design. The survey or descriptive method will be used to conduct this study. The students will be given two scales to measure attitudes toward mathematics --a three question true/false scale and Aiken's Math Attitude Scale. They will also be given an achievement test, a

personality inventory, and an anxiety test. The students with negative attitudes toward mathematics will also be given a personal interview in order to discover some of the reasons for the negativism they feel toward mathematics. The data will then be analyzed statistically by comparing persons with positive attitudes toward mathematics with those who have negative attitudes toward mathematics and also with regards to differences based on sex.

1.5 Definitions

1. Achievement: The breadth of information acquired by an individual --academic knowledge.

2. Achievement in mathematics: An individual's understanding of mathematical concepts, ability to manipulate mathematical ideas, and degree of computational proficiency.

3. Anxiety: A state of being uneasy, apprehensive or worried about what may happen.

4. Anxiety toward mathematics: Anxiety associated with number manipulation or mathematical concepts.

5. Attitudes: Enduring predispositions which are learned rather than innate, are subject to change, are a result of a commingling of personal and societal values and are manifest by the manner in which one acts, feels,

and thinks.

6. Attitudes toward mathematics: Exemplified by like or dislike of mathematics; feelings as to its importance in relation to other subjects; boredom with; and, the ease or difficulty with which one views mathematical concepts.

7. Negative attitudes: Resisting or opposing responses characterized by doubt and question.

8. Negative attitudes toward mathematics: Opposing and resisting responses toward learning, experiencing, or discussing some or all mathematical concepts.

9. Positive attitudes: Confident and assured responses characterized by certainty and affirmation.

10. Positive attitudes toward mathematics: Confident and assured responses toward learning, experiencing or discussing some or all mathematical concepts.

11. City college: A community college. (See No. 12)

12. Community college: A two-year post-secondary institution with an open-door enrollment policy. The available educational offerings are:

1) terminal programs of general education
2) vocational programs
3) preparatory programs for persons entering four year institutions
4) continuing education

13. Mathophobia: An irrational and impeditive dread of mathematics.

14. Personality: The characteristics that determine an individual's interpersonal behavior in social living and social interaction in any setting, culture or circumstance.

1.6 Organization of Succeeding Chapters

The remainder of this research will contain five additional chapters. Chapter Two will contain a review of related literature. The content will be divided into five parts dealing with attitudes toward mathematics of elementary school students, high school students, post-secondary students, and the implications of sex. Each section will discuss the research done on attitudes toward mathematics with reference to such intellective and non-intellective variables as achievement, teacher's influence, teaching methods, parental influence, personality traits and degrees of anxiety. A summary will follow which will discuss the significance of the related studies and their relationship to this research.

The demograph of the study will be presented in Chapter Three. It will also contain a list of the instruments to be employed for collecting data, provide a des-

cription of the instruments, and describe what each is designed to measure. The population and sampling technique will be described. All procedures used for the study will be presented followed by a summary.

Chapter Four will contain descriptions, highlights, charts, and tables to explain and analyze the data. The sources of negative attitudes toward mathematics will be enumerated and catagorized as they pertain to students at Kennedy King College of Chicago. It will also contain an analysis of the data with reference to statistical significance of the recorded results as it pertains to attitudes and characteristics of personality.

Chapter Five will contain conclusions based on analyses of the data gathered in this study. Also contained in Chapter Five will be recommendations for immediate action, and for long range plans. Further research will be recommended based on possible contradictions and limitations which may result from the present study.

Chapter Six will contain a summary of the study and a restatement of the problem in light of the findings.

1.7 Summary

People who have mathophobia need to be re-educated.

Misconceptions can and should be replaced by re-thinking and new outlooks where mathematics is concerned. This is necessary not only for an individual to attain full worth, but also because it becomes important for the development of the nations' most precious natural resource --the human mind.

It would seem that the school system must share in the responsibility of restructuring attitudes toward mathematics in people, because the system was instrumental in perpetuating mathematical negativism, no matter how innocently.

The purpose of this study will be to aid in the process or restructuring attitudes toward mathematics so that they become more positive by discovering the source of negative attitudes demonstrated by students in a city college in Chicago and then making recommendations for preventative programs and also programs that will contain curative and lenitive features.

CHAPTER II

RESEARCH OF ATTITUDES TOWARD MATHEMATICS

2.1 Introduction

Attitudes together with wants and interests influence and modify the behavior of people. The impact of the importance of attitudes increases with the realization that they are strengthened and weakened by the course of inner development and also by experiences of life. Attitudes are a dynamic and ever changing aspect of ones personality. Little wonder that numerous studies have been conducted on the impact of attitude on education and vice versa.

This review will contain research on attitudes toward mathematics with respect to elementary school students, high school students, and college students. Each level will contain a section on studies of attitudes toward mathematics and also attitudes toward mathematics with respect to the following intellective and non-intellective variables: achievement; teacher's influence and teaching methods; parental influence; and personality. The fourth section will include research conducted on the influences exerted by cultural phenomenon as is relates to sexism. The fifth and final section of this chapter will contain conclusions based on the previously discussed

research and application to the present study.

2.2 Elementary School Students

Attitudes Toward Mathematics. Research measuring the attitudes of elementary school students has been conducted using a variety of scales. Fedon (1958) and Callahan (1971) used Dutton's scale on third and eighth graders respectively. For third graders attitudes play an important part in the success of the arithmetic programs --very definite attitudes for and against arithmetic are being expressed at this level. The eighth graders reported that lasting attitudes about mathematics developed at each grade with girls showing about the same dislike for mathematics as boys. Scharf (1971) used the semantic differential technique to measure attitudes. His results, together with those of Haladyna and Thomas (1977) found that attitudes toward mathematics had a fairly stable pattern in elementary school children. Haladyna and Thomas (1977) used a two instrument battery designed by them to conduct a study of the attitudes of two thousand, eight hundred-forty-six elementary school students in Oregon. The purpose of the instrument, which had two forms, one for primary grades and the other for intermediate grades, was to determine

the relative degree and magnitude of attitudes toward school and toward five to seven subject matter areas, one of which was mathematics. The following results were reported:

> Any suspicion that "mathophobia" is a tendancy in elementary school children was not supported by these data. Both reading and mathematics are rated in the middle scale.... (pg. 13).
>
> Mathematics shows a slight increase in the primary grades, and slight decrease in the intermediate grades and junior high school, but neither of these was practically significant (p. 18).

Stright (1960) and other researchers as reported by Aiken (1970) also duplicated the result that very definite attitudes toward mathematics begin to develop at the third-grade level, but reports indicate that in each succeeding grade negative attitudes toward mathematics appeared.

Attitudes and Achievement. Research indicates that there is a significant correlation between attitudes toward mathematics and achievement. Feierabend (1960) sighted numerous studies that found relative students' preference to be highly related to accomplishment in mathematics, science, and language. The studies maintained that a preference for a subject is related to achievement once variations in mental ability are held constant. Aiken (1970) listed no less than nine studies dealing with attitude toward mathematics

and achievement. Some of the findings were that persons disliking mathematics exhibited feelings of frustration, poor self-image, and extreme anxiety as a result of repeated failures when in mathematical situations. Students who like mathematics were found to exhibit constructive perserverance to solutions of mathematical problems. It was also found that the self-perpetuating cycle linking expectations and performance increases as students advance in school. "That is, the difference in performance between the poorest and the best pupils becomes progressively greater as they ascend the academic ladder" (Aiken, 1970, p. 559).

Neale (1969) writes that it is at least fair to hypothesize that current school programs result in a substantial decline in the favorableness of attitude toward learning mathematics as children progress in school. And his findings were that attitudes play a modest role in mathematical achievement because positive or negative attitudes toward mathematics appear to have only a slight causal influence on how much mathematics is learned, remembered, and used.

> The second purpose of the study was to investigate the predictive role of attitudes in school achievement. Results of the multiple regression analysis, ... revealed that attitudes toward school subjects

> as measured by the Semantic Differential make little or no contribution to predictions of achievement (p. 234).

Additional research by Neale (1970) produced similar results, i.e., that attitudes play little or no role in the prediction of achievement in mathematics. His results were supported in separate studies conducted by Abrego (1966) and Shepps (1971) when they found no significant correlation between achievement and attitudes toward mathematics.

In an article published as a direct reply to Neale's results, Aiken (1970) writes that research on the question of how attitudes and achievement interact must be preceded by the design of more reliable and valid multidimensional measures of attitudes which are applicable to various age groups. However, Suydam (1970) also agrees with Neale and others that there is no consistent evidence of research to support the popular belief that there is a significant positive correlation between students' attitudes toward mathematics and students' achievement in mathematics.

Attitudes and Teacher's Influence. Several studies have been conducted to measure the students' attitudes toward mathematics as influenced by the teacher's attitudes. Lerch (1969), Capps (1969), and Suydam (1970) found that

the teacher's attitudes and teaching methods are basic in determining the child's successes in arithmetic and attitudes toward arithmetic. There is a positive correlation between the attitudes the teacher possesses and the attitudes their students acquire. In previous studies, however, Feierabend (1960) reported that teacher's influence was less operative than parental influence because many members of the negative group reported liking the teacher but not liking the subject. In studies conducted by Anttonen (1971) and Gilbert (1976), the findings did not support the generally expressed belief that there is a positive correlation between arithmetical attitudes of teachers and students.

Attitudes and Teaching Methods. Various teaching methods have been employed by Higgins (1970) and Edwards (1974) to improve attitudes of elementary school children toward mathematics. Although in each of the following studies methods were used to control the nature of group formation, the two techniques of 1) teaching mathematics through science, and 2) teams-games-tournaments, produced insignificant changes in student's attitudes toward mathematics. Entwisle's (1975) research on first graders was conducted using individual interviews and a brightly-colored plastic sheet designed to resemble a report card. The interviews were

designed to measure the child's grade expectations in reading, arithmetic, and conduct. After determining that the children understood the report card and the value placed on the numbers one, two, three, and four, they were asked to guess what number they would receive on their report card in each of the three areas. A result of the interview porcess was:

> Before their first report card children of both races are highly optimistic about their forthcoming marks in reading and in conduct. Children of both races are noticeably less optimistic about their forthcoming marks in arithmetic. Whites estimated an arithmetic mark 0.23 units lower than blacks (pp. 5 and 6).

The Panel Study conducted by the Pontiac City School District in Michigan (1975) found that the race of a student does not have a statistically significant effect on attitudinal change because in each race attitudes toward school become more positive from sixth to seventh grade while attitudes toward mathematics became more negative during the same period.

Attitudes and Parental Influence. Studies measuring parental influence have been conducted by measuring students' impressions of parental influence and also by conducting surveys of the parents. In those studies which measured student's responses, three results emerged as parental influences: namely: 1) expectations of child's achievement; 2) encouragement; and, 3) parent's own attitudes.

Some of the findings from interviews of parents were that student's attitudes were positively correlated with the amount of mathematics desired by the parents and also a positive correlation was seen with the parent's views of competition as good and as necessary in the modern world (Poffenberger and Norton, 1959, Aiken and Dreger, 1961, and Aiken, 1970).

Entwisle's (1975) study investigated the influence of three variables on parental expectations of their childrens grades. The variables were: 1) the child's IQ, 2) number of days absent, and 3) number of days tardy. The findings were:

> There are significant but small correlations between IQ and parents' first expectations for the combined races. . . . When the races are examined separately, white parents' expectations in all three areas are significantly more strongly correlated with IQ . . . while black parents' correlations are consistently weak and nonsignificant. . . The children, whether white or black, and black parents seem oblivious to IQ in shaping their expectations (p. 7).
>
> There are highly significant correlations . . . between absences and parent's expectations in both reading and arithmetic. . . In this lower-class school parents who have low expectations apparently tend to keep (or allow) their children out of school more. Perhaps these parents feel their children are not likely to profit much from instruction, and therefore missing a day now and then is not a serious loss (p. 9).

> Correlations between lateness and marks are similar to those observed between absences and marks despite the modest correlation between absences and lateness.... Frequent lateness is significantly... associated with poorer marks in reading and arithmetic throughout first grade but it bears no relationship to the children's reading and arithmetic expectations at any time in first grade (p. 9).

Attitudes and Anxiety. A number of studies have been conducted relating anxiety to performance in mathematics with elementary school students and the results showed a small but statistically significant negative correlation occurred between manifest anxiety and achievement (Aiken, 1970).

2.3 High School Students

Attitudes Toward Mathematics. A series of studies have been conducted to measure and explain attitudes of high school students toward mathematics. Subject-preference tests showed mathematics to be among the first three preferences in rank order. This is important in view of other findings which maintain that preference for a subject is related to achievement once variations in mental ability are held constant (Feierbend, 1960).

In Dutton's (1956) study of the feelings of four-hundred

fifty-nine, junior high school students, he found that eighty-nine percent enjoyed doing problems when they knew how to work them. They also stated that they disliked mathematics when they did not understand it or because it was boring. Some of the reasons given for liking mathematics were its practical aspects --mathematics is needed in life-- and the enjoyment gained from working problems. In a follow-up study ten years later, Dutton (1968) found that there had been a change in the attitudes of high school students. Some of the findings were:

1) fewer students are afraid of mathematics
2) there is an increase in the number of students who enjoyed the challenge presented by mathematics
3) students who expressed a strong interest in working with numbers have decreased
4) approximately sixty-seven percent of the students tested enjoyed the challenge presented by mathematical problems.

Several studies report the persistence of negative attitudes toward mathematics as students progress in school with a large percentage believing that mathematics should be avoided whenever possible because it is a waste of time. However, in a study by Roberts (1970) to learn how high school students felt about mathematics, it was found that

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college bound seniors scored significantly higher than others on a scale which measured attitudes toward mathematics as a process.

Attitudes and Achievement. Studies measuring the correlation between attitude and achievement at the high school level have had varying results. Feierabend (1960) indicated that some of the explanations given for these results are the influence of success-or-failure experiences, the influence of the home, and performance based on differences in sex.

Anttonen (1969) did a longitudinal study over a six-year period to examine the stability of mathematical attitudes and to relate mathematical attitudes to achievement. Although interpretations of the results are difficult because such studies were almost non-existent at that time, he found a significant correlation between mathematical attitudes and achievement at the secondary level.

Attitude and Teacher's Influence. "It is generally held that teacher's attitude and effectiveness in a particular subject are important determinants of student attitudes and performance in that subject" (Aiken, 1970, p. 572).

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Although several studies have shown that there is a significant correlation between teacher's attitudes and student's achievement, the results pose the cause-effect question, i.e., do teacher's attitudes and achievement effect student's attitudes and achievement or vice versa? (Aiken, 1970). A study conducted by McConnell (1977) to relate teacher's behavior to student's achievement and attitudes of ninth-grade students in algebra found a positive correlation to attitudes, if the teachers provided an opportunity to learn, taught with clarity, exhibited enthusiasm, and acted in a businesslike manner.

Attitudes and Teaching Methods. Many teaching methods have been used in an attempt to improve student's attitudes in high school toward mathematics. The more noteworthy included motion pictures, experimental programs, programmed texts, varying attendance plans, and calculators. Tiemans (1962) researched the effect that the use of films and printed booklets would have on attitudes toward mathematics, and he found that the films were greatly favored. Ryan (1967) found that ninth graders experienced more difficulty when taught by experimental methods which contributed to a more negative attitude toward mathematics.

> Examination of several instructional factors to determine their contribution to the attitudinal outcomes revealed large instructional program differences in pupil judgments of their instructional materials. Both the Ball State and SMSG instructed pupils reported relatively greater difficulty understanding their texts much more frequently than did conventional class pupils.
>
> The results also indicated that "textbook difficulty" was a factor affecting end-of-year scores on the attitude indices and further that this factor contributed to a more negative attitude than would otherwise have been observed for the Ball State and the SMSG instructed pupils (p. 67).

Hagan's (1967) study of programs using conventional texts, programmed texts, independent studies, and variations of amounts of class time, and Cech's (1970) study to determine whether the use of a calculator by low achievers in ninth grade would improve their attitudes toward mathematics had similar results in that both researchers reported that the aforementioned techniques did not affect the students attitudes toward mathematics.

Attitudes and Parental Influence. In an interview of mothers and fathers of upper-middle class boys, a similarity was found between the attitudes of mothers and sons. It was also found that parental attitudes and expectations for sons were not significantly related (Aiken, 1970).

Attitudes and Personality. There are many references that discuss the relation between personality and achievement. When underachievers and overachievers were studied, it was found that high achievers were superior in high school marks, study habits, analytical thinking, industriousness, and attitudes toward mathematics. Students who scored high on a stereotyped test were found to be better in mathematics and science (Feierabend, 1960). "Collectively, the findings of studies relating personality variables to mathematical attitudes and achievement indicate that individuals with more positive attitudes and higher achievement tend to have better personal and social adjustment than those with negative attitudes and low achievement" (Aiken, 1970, p. 572).

2.4 Post Secondary Students

Attitudes Toward Mathematics. Numerous studies show very definite mathematical attitudes exist in post-secondary students after a dozen years in school. Cristantiello (1962) surveyed two-hundred-sixty-four college sophomores and found a high correlation between the ACE Psychological Examination as a predictive variable with students who possessed a most neutral score on a mathematical attitudinal scale. Robert's (1969) study of students from four-year and two-year colleges

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enrolled in terminal and non-terminal classes in mathematics found that majors in mathematics have a significantly more positive attitude toward mathematics than other students. She also found that students in evening terminal classes in mathematics had a higher positive attitude. Aichelle (1971) measured change in student's attitude enrolled in a terminal class in mathematics designed to improve attitudes toward mathematics and found that students felt mathematics required too much memorizing, usually had some rule to follow, and were uncertain as to the usefulness of advanced courses in mathematics.

Aiken (1972), McCallon (1971), and Knaupp (1973) also conducted studies to measure the mathematical attitudes of college populations. Some of their findings were that:

1) men had more positive attitudes toward mathematics than women
2) attitudes toward mathematics were related to routine computations, mathematics symbols and terms, and word problems
3) a semantic differential is as affective a method for measuring mathematical attitudes as the mathematical attitudinal scale
4) most students fearing and disliking mathematics met with frustration in the elementary grades.

Attitudes and Achievement. Aiken and Dreger (1960),

Aiken (1972), and Brown (1972) have also conducted studies measuring attitudes toward mathematics and achievement. The findings were that attitudes toward mathematics are positively correlated with achievement in mathematics. Brown (1972) also found that the effect of attitude on achievement is independent of the method of instruction. Research conducted on methods to improve attitudes and achievement by Brown (1972) assessed the effects of teaching freshmen students in mathematics with the Spitz Student Response System. He found that although attitudes improved, achievement did not. McBride (1977) and Rollins (1977) did research to determine if the history of mathematics would improve attitudes of one-hundred-twenty college students toward mathematics. Each found that attitudes did improve in the experimental group who weekly received five minute discussions on the history of mathematics throughout the course.

Attitudes and Teacher's Influence. Considerable research has been conducted to measure the influence of teachers on the attitudes toward mathematics of students. Therefore, it would seem apropos to measure the attitudes of prospective teachers toward mathematics. Dutton (1951)

and (1955), Kane (1968), Reys and Delon (1968), Kockler (1973), Netusil (1974), and Johnson (1976) conducted studies to measure the attitudes of prospective teachers toward mathematics. The results of these studies were that a high percentage of prospective teachers have an unfavorable attitude toward mathematics. Some of the reasons given were lack of understanding, boring drill, poor teaching, fear of word problems, fear of subject in general, and a feeling that mathematics is awful and unpleasant. Johnson (1976) reported that her findings:

> . . . show some disturbing tendancies. Among the elementary education majors, an alarmingly high percentage hated and/or feared mathematics and thought of it as awful, unpleasant, and/or bad. These attitudes are unfortunate for this group of students who plan to teach in the elementary grades.
>
> This researcher feels that attitudes toward mathematics are important and that investigations should be made to determine whether elementary education majors are aware of their attitudes and the impact they might have (pp. 215 and 216).

It was also felt that the problem of negative attitudes toward mathematics will not be alleviated until favorable attitudes are fostered throughout the elementary, secondary, and post secondary school years.

Poffenberger and Norton (1955) and (1959), Aiken and

Dreger (1960), and Aiken (1971) have done research on the teachers' influence on college student's attitudes toward mathematics. The findings indicate that teachers who like mathematics convey positive attitudes to their students and that students who dislike mathematics tend to blame the teacher.

Attitudes and Parental Influence. Parental influence on the attitudes toward mathematics of college students have been assessed in studies by Poffenberger and Norton (1959) and (1955), Aiken (1972), and Aiken and Dreger (1960). The results were that although both parents' expectations and encouragement determine and influence students' initial attitudes toward mathematics, the father's attitude is a significant factor in the attitude of males, whereas the mother's attitude was more significant for females.

> The data ... for the college freshmen illustrate that a number of familial variables are related to attitude toward mathematics. More specifically, the findings ... for the graduate students suggest that the father is a significant factor in determining attitudes of males. Interestingly, the "father" variables were not related to the attitudes of the females in any of the groups nor of the college freshmen males. .... In general, the "mother" variables tend to be somewhat more significant for females than for males in the eighth grade and freshmen groups; none of the "mother" variables was significant for the graduate students (pp. 388 and 393).

Attitudes and Personality. The effect of personality on attitudes toward mathematics was researched by Lambert (1960) and Carlson (1970). Lambert (1960) used the Minnesota Multiphase Personality Inventory to measure the masculinity of mathematics and non-mathematics majors. Contrary to popular belief, that women mathematical majors are more masculine than non-mathematical majors, it was found that the female mathematical majors were significantly more feminine than the female non-mathematical majors.

Dreger and Aiken (1957) and Ohlson and Mein (1977) researched the degree of mathematical anxiety in some samples of the college population. The results of Dreger and Aiken's (1957) study were that there is a separate "number-anxiety" factor which is not related to general intelligence and that people with high "number-anxiety" tend to make lower grades in mathematics.

> Recent data indicate that many persons suffer from anxiety as stimulated by mathematics cues. For example, a survey by Richardson of a sample of nearly four hundred undergraduates, roughly 28% exhibited extreme levels of tension associated with mathematics situations or number manipulations. Over one-third of the students actively seeking help through a counseling center behavior therapy program reported their primary problem as being connected with mathematics (Suinn, Edie, Nicoletti and Spinelli, 1972, p. 373).

Ohlson and Mein (1977) on the other hand found mathematical majors were not more anxious than non-mathematical majors.

Attitudes and Other Variables. Recent studies have been conducted to measure the attitudes and other non-intellective variables of community college students and black students toward mathematics. Johnson (1971) conducted a study with students attending the University of Minnesota on the effect of one's attitude toward mathematics on interpersonal attraction. He found that people tend to like people who hold similar attitudes toward mathematics and dislike people who hold dissimilar attitudes toward mathematics. Jackson's (1973) research was done with two-hundred, black, first-year college students in Indiana. He found a significant positive correlation between the attitudes of disadvantaged students and their achievement in elementary mathematical courses. He also found that these students experienced a significant positive change in attitudes toward mathematics when taught in small groups by competent, experienced teachers of mathematics who were sensitive to the students' needs and goals.

In an attempt to determine the characteristics of low achieving students of mathematics at a community college, Pearce (1976) found that low achieving students of mathematics have a poorer attitude toward mathematics than the average or better students of mathematics and that black college freshmen are more likely to be low-achievers in mathematics than are the white, college freshmen. When Bottorff (1973) measured the effects that teaching of the uses of mathematics had on attitudes toward mathematics, he found a significant difference favoring those students who studied the uses of mathematics when those uses were related to the student's area of specialty.

2.5 The Effects of Sexism

Cultural Phenomenon. There have been at work in society very definite sex-role factors (sexualities) which have a tremendous influence on the attitudes of people toward mathematics, who should be involved with mathematics, and also to what degree. Motivation, can be viewed as governed by many variables, but perhaps sex-role identification is one of the most influential in this society.

Fehrabend (1960) writes that research for the period 1948 to 1958 supports the theory that girls dislike arith-

metic more than boys; however, one study found that sexual differences in subject preference did not crystallize until high school. She goes on to postulate that one explanation for factors underlying attitudes toward mathematics might be sex because differences in performance on the basis of sex do exist which are probably due to different attitudes held by the two sexes. This is possibly related to a masculinity-femininity role image or to other sexual differences in non-intellective variables.

Four Hypotheses to Account for Sex Differences. An investigation by Aiken (1970) states that four hypotheses have been proposed to account for sexual differences in mathematical abilities. They are:

1) the masculine identification hypothesis
2) the differential, social, reinforcement hypothesis
3) the same-sex role modeling hypothesis
4) the sex-linked, recessive-gene hypothesis

He then proceeds to reveal the contradictions inherent in each of the aforementioned hypotheses as found through his research. The results of one study conducted with one-hundred-eleven male and one-hundred-twenty-eight female college sophomores contradicted the theory that attitudes toward mathematics are related to masculine

aggression. He found that mathematical attitudes are negatively related to emotional stability and need for aggression. His findings from a study involving eighth-grade students were also inconsistent with the masculine identification and the sex-linked, recessive-gene hypotheses, because his conclusions were that a females' mathematical ability was independent of a father's reported mathematical ability, and a male's mathematical ability was positively related to the father's reported mathematical ability. Aiken (1970) reports that:

> ...the results of two orthogonal powered-vector factor analyses --one for 72 eighth-grade girls and the second for 84 eighth-grade boys-- based on five ability measures, score on the Mathematics Attitude Scale, and scores on 16 items of a specially designed biographical inventory ... obtained two independent factors for girls and one factor for boys. Factor A in both cases is interpreted as "Student's Mathematical Ability," and Factor B for girls is "Father's Reported Mathematical Ability." ...since Factors A and B are orthogonal, it may be concluded that for the females "Student's Mathematical Ability" was independent of their "Father's Reported Mathematical Ability." In contrast, for males "Student's Mathematical Ability" was positively related to "Father's Reported Mathematical Ability." These findings are clearly inconsistent with both the "masculine identification" and "sex-linked recessive gene" hypotheses (pp. 5 and 6).

Preferences of Girls and Boys. One of the numerous studies that have been conducted to determine socio-cultural influences on attitudes toward mathematics attempted to dis-

cover whether any significant relation exists among the subject preferences of girls and boys. Mosher (1952) found little significant difference between the choices of girls and those of boys in elementary grades; however, sex differences in subject preferences grow progressively greater in number as maturation develops. Similar results were obtained by Sherman (1976) in a study involving two-thousand male and female sixth-to-twelfth graders. He found that girls do as well as boys in grades six to eight. He also found that attitudes related significantly to mathematical achievement and that social and cultural influences were strongest in high school where parents and teachers were perceived as less positive toward females as learners of mathematics.

Tobias (1976) discovered that mathematical avoidance grows from a culture that makes mathematical ability a masculine attribute by punishing women who do well in mathematics and soothing the slower learner by telling her she does not have a mathematical mind. The development of attitudes opposed to mathematics is associated with socializing practices in school according to Kaminski (1976). He goes on to write that parents seem to have a greater impact on attitudes toward mathematics through their evaluations of

the daughters' self-conceptions of her mathematical ability. For sons, parents are not as influential. In an experimental program involving twenty-six gifted girls, Fox (1976) found that without intervention, significant differences result between girls and boys with respect to courses chosen for study.

> In the absence of special intervention efforts for girls, it appears that boys and girls with similar mathematical and verbal aptitudes and family backgrounds differ significantly with respect to course taking behavior in mathematics by the end of the tenth grade. Course taking behavior of gifted girls, however, was modified by early intervention. The experimental girls have kept pace with the boys (p. 11).

International Implications. In an international study involving twelve countries, Husen (1967) found that specialization in mathematics is strongly biased against females. Therefore, greater interest is shown by boys in all countries except France, England, and Sweden. Kaminski (1976) also found that typical sex differences in mathematics apparent in the United States are not found with Eskimo women or Swedish students.

Sexual Attitudes and Personality. Aiken (1963) conducted a study of one-hundred-sixty, college, sophomore

women to determine if attitudes toward mathematics are a reflection of more general personality traits. Females were selected because non-intellective factors are more influential in determining their attitudes toward mathematics than those of males. His results suggest that high scorers on an attitudinal scale, with mathematical ability statistically controlled, tend to be:

1) more socially and intellectually mature
2) more self-controlled
3) place more value on theoretical matters than low scorers on the scale.

2.6 Conclusion

The presentation of existing research is not intended to be all encompassing, but it attempted to show the scope of research relating to attitudes toward mathematics. There has been much research conducted at all educational levels --elementary, high school, and post secondary. The studies have investigated such intellective and non-intellective variables as achievement, teacher's influence, teaching methods, parental influence, anxiety, and personality. Studies have also been conducted that measure the impact of sexist attitudes and their influence on attitudes toward mathematics.

A conclusion that can be drawn from the available research is that attitudes are important. Positive attitudes toward mathematics encourage the continuous study of mathematics; negative attitudes are associated not only with discontinuing the selection of courses in mathematics but also with poor achievement. Society and parents positively influence the choice of mathematics by boys and negatively effect girls' attitudes toward mathematics. This evinced by the fact that in elementary grades girls and boys have similar attitudes toward mathematics but a change begins to make an appearance at the high school level when girls feel pressures from all facets of society.

The research indicates that several questions are unanswered. It was particularly evident that research on underachievers in an urban community college has not been conducted. This to some degree is understandable, because the development of community colleges is relatively recent and the opportunities for black people to attend college has been limited since the inception of post-secondary education. Another fact which is an outcome of the research is that mathematics does cause anxieties which are directly associated with mathematics and when these anxieties are alleviated a

more positive approach to mathematics is the result.

2.7 Implications For This Study

Much research has been conducted on the impact of attitudes and learning. Studies have been conducted correlating attitudes with achievement, personality, anxiety, teaching techniques, teacher's influence, parental influences, and the effects of sex. The results indicated that attitudes do influence learning and also that society is biased where women and mathematics are concerned.

The present study, therefore, will attempt to determine some reasons for negative attitudes toward mathematics of students at an urban community college by first determining which attitudes do in fact exist, and then, measuring achievement, personality, and anxiety to identify possible correlates. These correlates might be distinct, unusual, or peculiar to persons possessing negative attitudes toward mathematics. Once these persons have been identified, personal interviews will be conducted to ascertain some of the causes of negative attitudes toward mathematics.

Upon completion, this research will test the following hypotheses:

1. Community college students with negative attitudes toward mathematics are lower achievers than those with positive attitudes toward mathematics.

2. Community college students with negative attitudes toward mathematics possess unique mathematical anxieties.

3. Community college females possess a more negative attitude toward mathematics than do males.

4. Community college students with negative attitudes toward mathematics possess definite personality traits different from those with positive attitudes toward mathematics.

5. There are specific factors contributing to the acquisition of negative attitudes toward mathematics of community college students.

The methodology for testing these hypotheses will be explained in the following chapter.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The population for the present study are students at Kennedy King College. Kennedy King College is located in south-central Chicago and it has the third largest black enrollment in the United States. The attitudes toward mathematics of a portion of these black students will be ascertained and nonparametric statistical procedures will be used to determine existing correlations with mathematical anxiety, achievement in mathematics, and various personality components including dominance and femininity.

Variables to be Measured. The present research presumes that innumerable factors are instrumental in affecting the development of attitudes. This study will explore several of the variables and measure possible correlations existing among them. The intellective and non-intellective variables to be measured are:

1. Anxiety toward mathematics
2. Achievement in mathematics
3. Personality components
    1) Class I - Measures of poise, ascendancy, self-assurance, and interpersonal adequacy
        a) dominance

b) capacity for status
c) sociability
d) social presence
e) self-acceptance
f) sense of well-being

2) Class II - Measures of socialization, responsibility, intrapersonal values, and character

a) responsibility
b) socialization
c) self-control
d) tolerance
e) good impression
f) communality

3) Class III - Measures of achievement potential and intellectual efficiency

a) achievement via conformance
b) achievement via independence
c) intellectual efficiency

4) Class IV - Measures of intellectual and interest modes

a) psychological-mindedness
b) flexibility
c) femininity

Nonparametric Statistics. The subjects in the present study do not represent populations with normal distribution. Therefore, nonparametric statistical procedures will be used because they are techniques of inference that are distribution free. Nonparametric statistics are ranking or order tests, and they focus on the order or ranking of scores. Parametric tests focus on the difference between the means whereas nonparametric tests focus on the difference between the medians.

Some of the advantages and disadvantages of nonparametric

procedures as listed in Siegel (1956) are as follows:

1. Advantages

   1) Probability statements are exact probabilities except in the case of large samples.

   2) If N=6, there is no alternative to using a nonparametric statistical test (unless the nature of the population distribution is known exactly).

   3) Samples consisting of observations from several different populations can be suitably processed.

   4) Data can be analyzed which are inherently in ranks as well as data with seemingly numerical scores which have the strength of ranks.

   5) Methods are available to treat data which are simply classificatory.

2. Disadvantages

   1) If all the assumptions of the parametric statistical model are in fact met in the data, and if the measurement is of the required strength, than nonparametric statistical tests are wasteful of data.

   2) There are no methods for testing interactions in the analysis of variance model, unless special assumptions are made about additivity.

   3) The tests and their accompanying tables of significant values have been widely scattered in various publications --many are highly specialized and have therefore been comparatively unaccessible to the behavioral scientists.

The nonparametric statistical tests to be used in the present study are the Spearman-Rank Correlation-Coefficient (r_s) and the Kolmogorov-Spirnov test. The efficienty of the Spearman-Rank Correlation when compared with the most powerful

parametric correlation, the Pearson r, is about ninety-one percent (Siegel, 1956).

3.2 The Community

Kennedy King College is located in the Englewood Community which is a five-square-mile residential neighborhood with approximately one-hundred-thousand residents. It is bounded by the Dan Ryan Expressway on the east, 75th Street on the south, on the west by Ashland Avenue and on the north by 55th Street. Its residents are predominantly middle aged, and the area suffers from the same ailments of most inner city communities, namely:

1. inadequate recreational facilities
2. overcrowding
3. lack of modernization in shopping facilities, housing, schools, parks, transportation, and streets.

The properties are older homes, and many like the streets and other public facilities are in need of repair, refurbishing, and rebuilding.

Social and Cultural Characteristics. Ninety-six percent of Englewood's total population is black, with about two percent Spanish-American and approximately one and one-half percent foreign born. The median educational level for females and

males is about two and one-half years of high school, with about thirty-one percent of the females and twenty-seven percent of the males completing high school. About six and one-half percent of the males and sixth-tenths of one percent of the females complete four years of college.

Economic Characteristics. The economic status of the residents is very low, and of the approximately twenty-five-thousand housing units in the community only about six thousand are owned by black residents. The median income of the approximately twenty-five-thousand, five-hundred families is $7,500.00 with sixty-nine percent earning under $10,000.00 and five percent earning over $25,000.00. Approximately six percent of the residents are on social security, and about ten percent are receiving some form of public assistance.

3.3 The City College System

The City Colleges of Chicago offer a comprehensive educational program designed to serve the interests, aptitudes, and abilities of the student body through the following major areas of study:

1. General programs
2. Business
3. Creative, cultural and performing arts
4. Engineering and industrial

5. Health

6. Public and human services

7. Adult/continuing education

Educational Purposes and Options. The seven areas mentioned above serve several purposes and offer the following options:

1. College work preparatory to transfer to a four-year baccalaureate degree-granting senior college or university.

2. Preparation for technical, semi-professional and mid-management positions in business, industry, and government

3. General Programs which provide a broad educational base designed to help the student to understand himself and his world, to mature and build self-confidence, and to function as a competent, responsible citizen

4. Upgrading and updating skills of employed persons in job specialities, both to improve present performance and to prepare for more responsible positions

5. Job skill training for the unemployed and underemployed

6. Development of basic literacy and arithmetic for persons whose early education was inadequate and/or acquired in a language other than English

7. Preparation for completion of high school requirements through evening high school credit courses or General Educational Development tests

8. Informal educational opportunities through community services such as workshops, lectures, forums, discussion groups, and cultural events

9. Special programs for the handicapped

Educational Programs. The educational program consists of Associate Degrees and Diplomas of sixty to sixty-four semester

hours and Certificates or shorter programs of less than sixty hours. They are as follows:

1. Associate in Arts (AA)-- a program designed for students planning to receive a baccalaureate degree from a senior college or university. It consists of general education courses, special courses related to the student's major field of study and general courses.

2. Associate in Applied Science (AAS)-- a program that has a dual purpose degree. It is for students wishing to acquire skills preparing them for a career which may begin during their community college work or immediately upon graduation. The AAS degree also permits a student to continue his career preparation at a senior educational institution.

3. Diploma-- a diploma is awarded to students who successfully complete sixty hours of credit, but who do not meet the specified requirements for the Associate in Arts or Associate in Applied Science Degree.

4. Certificates-- certificates are awarded upon successful completion of small clusters of courses designed to give the student a certain level of skill and/or knowledge.

Admission Practices. Students are admitted to the community colleges on an open-door policy which means that adults of all ages who wish to work toward a college degree, prepare for a career by acquiring a marketable skill, increase potential for promotion, or study for self-enrichment are eligible to enroll. The following criteria are used for admission:

1. Graduates of accredited high schools (including General Educational Development [G.E.D.] equivalent)

2. Any adult eighteen years of age or older

3. Special students (residents who are eighteen but do not fultill other admission requirements and students sixteen and seventeen who have been officially separated from the Chicago Board of Education)

3.4 Kennedy King College

History. The population to be surveyed are students at Kennedy King College which is located on the south central side of Chicago. The student body is ninety-eight percent black, and the school is one of nine colleges in the City Colleges of Chicago system. Kennedy King College is a memorial to Dr. Martin Luther King, Jr. and Senator Robert F. Kennedy. The college was established in 1935 as Wilson Junior College, and the name was changed in 1969 to Kennedy King College. Originally housed in a structure on 68th and Stewart which it shared with Chicago State University until 1963, the college then relocated to a building on 70th and Steward which was its home until 1972. Kennedy King College moved into its new thirty-one million dollare campus in November, 1972. The eighteen-acre site, bounded on the north by Marquette (67th Street) Road and on the south by 69th Street, is unique in that the structure is built over Wentworth Avenue in such a way that the flow of traffic is not affected by it.

Special Features. The structure contains the following

special features:

1. A four-hundred seat theater for the exclusive use of the Theater Group
2. A Resource Skills Center where facilities are provided for computer programmed instruction and other recorded audio-visual learning support systems
3. A Child Development Center which provides area parents and community agencies with services and potential staff
4. A large gymnasium
5. A modern olympic-size swimming pool
6. Modernly equipped air conditioning, auto technology, photo offset printing, and radio and television broadcasting labs

Programs. In addition to a complete liberal arts program, Kennedy King College also offers special programs in business, secretarial science, nursing, child care, human development, and special technical programs which include air conditioning and refrigerating technology, automotive technology, photography, and photo offset printing, as well as the theater arts, radio, and television broadcasting.

3.5 Subjects

The present study began with a total of one-hundred-eight students. These students were enrolled in four mathematics classes of this researcher, and they had no previouw knowledge that the study was being conducted. Due to attrition, only

seventy-five persons completed all of the instruments used in this study and of that number forty-one completed the semester. Of the seventy-five students, forty-five were female and thirty were male. Forty-five were between the ages of seventeen and twenty-four, twenty-four were between the ages of twenty-five and thrity-six years, and five were between the ages of forty-one and sixty-four.

Sixty-one were high school graduates, the most recent in 1978 and the oldest in 1934. Of that number seventy-three percent of the women and eighty percent of the men were high school graduates. Eleven of the participants obtained high school credit through the G.E.D. (General Educational Development), which included seven women and four men. Forty percent of the students had taken two mathematical classes and twenty percent had taken three mathematical classes in high school. Seventy percent were taking their first college class in mathematics and seventy-two percent indicated that they intended to take other classes in mathematics while attending Kennedy King College. Twenty percent are married and fifty-three percent have children.

3.6 Materials

Seven instruments were used to collect data for the present study. They were:

1. A three-item true/false questionnaire
2. The Math Attitude Scale (MAS)
3. A biodata questionnaire
4. The College Qualification Tests
5. The Mathematics Anxiety Rating Scale (MARS)
6. The California Psychological Inventory (CPI)
7. A personal interview form

The true/false questionnaire and the MAS measure attitudes toward mathematics specifically. The MAS is a "Likert-type..." instrument that was designed by Aiken and he reports its reliability to be r = 0.94 for test/retest (Aiken and Dreger, 1960).

The biodata questionnaire and the personal interview questions were designed by the researcher. A pilot test was conducted on the biodata questionnaire and the personal interform with twenty students in four mathematics classes not being taught by the researcher. Five students in each of the four classes which were similar to those being used in the present study were asked to read and answer the statements and to question any items which they did not understand. As a result, some items were rearranged and others were reworded. These amended forms were used in the present study.

Biodata information was requested which would aid in the analysis of all data. The personal interview form was to be used only with students whose scores on the attitude scales indicated that they possessed negative attitudes toward mathematics. Therefore, the questions were designed specifically to discover some reasons for negative attitudes toward mathematics.

The MARS is a ninety-eight item self-rating scale which may be administered either individually or to groups. A test-retest reliability coefficient for the MARS was calculated and the Pearson product moment correlation was 0.78 and 0.68 over a two-week period and 0.85 over a seven-week period. The author of the test also reports an internal consistence reliability coefficient of 0.97 (Richardson and Suinn, 1973). Correlations between MARS scores and scores on the number portion of the Differential Aptitude Test (DAT) have a range of -.30 to -.64. The negative correlations indicate that MARS does indeed measure anxiety toward mathematics because high anxiety toward mathematics should be associated with lower performance on mathematical tests indicating that the test items are heavily dominated by a single, homogeneous factor, presumably anxiety toward mathematics.

The California Psychological Inventory (CPI) measures

characteristics of personality which have a wide and pervasive applicability to human behavior, and are related to the favorable and positive aspects of personality. The four-hundred-eighty items are divided into eighteen scales addressing personality characteristics important for social living and social interaction. The eighteen scales are grouped into the following four categories:

1. Class I - Measures of poise, ascendancy, self-assurance, and interpersonal adequacy
2. Class II - Measures of socialization, responsibility, intrapersonal values, and character
3. Class III - Measures of achievement potential and intellectual efficiency
4. Class IV - Measures of intellectual and interest modes

The CPI has been used with persons aged thirteen to seventy and according to indicators in the test of reliability and dependability, satisfactory results are obtained whether a formal testing session is used or if subjects are allowed to take the instrument home.

The College Qualification Tests (CQT) are a series of three ability tests developed for use by colleges. Subjects of this research were given only the numerical form. The numerical test contains fifty items, drawing on arithmetic, algebra, and geometry. It is aimed at conceptual skill in

simple mathematics not at computational or clerical speed. Normative and validity data are available for junior college students from twenty schools for 1957, and in 1967 a junior college normative study was conducted with five schools using three instruments, the CQT, the Davis Reading Test, and the Survey of Study Habits and Attitudes and the research showed substantial positive correlation with first semester junior college grades.

3.7 Procedures

Criteria For Selecting Subjects. The subjects for the present study are members of four mathematical classes taught by the researcher. They elected to take the course based on personal reasons and no attempt was made to alter the usual registration pattern in order to modify in any way those choosing to enroll in any one particular class.

A Descriptive Study. The research is designed to identify attitudes toward mathematics so that persons possessing negative attitudes toward mathematics may be isolated. Once the attitudes have been identified, nonparametric statistical procedures will be used to determine possible correlations existing between negative attitudes toward mathematics and each of the following: anxiety toward mathematics; special personality components; and achievement in mathematics.

Each student identified as having negative attitudes toward mathematics will be given a personal interview in order to ascertain some reasons for the negative attitudes.

Nonparametric statistical procedures were used because no attempt was made to normalize the sample for this study. The two nonparametric tests that will be used on the data are the Spearman-rank correlation-coefficient (r_s) and the Kolmogorov-Smirnow test. The Spearman-rank correlation-coefficient will be used to test the null hypotheses of attitudes toward mathematics and each of the following variables:

1. Anxiety toward mathematics
2. Achievement in mathematics
3. Personality components
    a) Class I
    b) Class II
    c) Class III
    d) Class IV
    e) Dominance
    f) Femininity

The Kolmogorov-Smirnov test will be used to measure the correlation between male and female attitudes toward mathematics.

Finally, all subjects identified as having negative attitudes toward mathematics will be given a personal interview using an instrument designed by the researcher specifically for the present study. Students identified as having the most positive attitudes toward mathematics will be used as

the interviewers, as it was decided that perhaps this would produce less tension and/or inhibitions in the interviewee than if the instructor conducted the interviews. It also was a time-saving technique.

3.8 Limitations

Community college students are a unique post-secondary population in that studies have shown that they have a very high attrition rate and very irregular attendance patterns. Because of these facts an attempt was made to administer most instruments in the class room setting, although it was not essential to do so with the California Psychological Inventory and the Mathematics Anxiety Rating Scale. In fact documentation indicates that CPI results are reliable whether administered as take home, male, or in a formal setting.

The California Qualification Test on the other hand is a timed instrument and it must be administered in a controlled setting. This researcher was certain that all data could be collected within four weeks of the beginning of the semester, but this was not the case, in fact the last bit of data was not collected until the twelfth week of the sixteen-week semester!

Attendance patterns are very irregular and I would there-

fore caution others to seriously consider the number of instruments to be used and the urgency necessary for immediacy in administering same when dealing with community college populations.

3.9 Summary

Kennedy King College, an urban community college which has a ninety-eight percent black enrollment provided the population for the present research. Students in four mathematics classes were given a total of seven instruments in order to identify correlations between negative attitudes toward mathematics and intellective and non-intellective variables and also to identify some of the reasons for negative attitudes toward mathematics.

The instruments and what they measure are as follows:

1. Attitudes toward mathematics measured by

   1) A three item true/false questionnaire
   2) The Math Attitude Scale (MAS)

2. Personal information obtained from a biodata form

3. Non-intellective variables obtained from

   1) The Math Anxiety Scale (MARS)
   2) The California Psychological Inventory (CPI)

4. Intellective variables measured by the California Qualification Test (CQT) form N only, to measure achievement in mathematics

5. Reasons for negative attitudes toward mathematics as discovered by personal interview forms

The data will be analysized using two nonparametric statistical tests, the Spearman-rank correlation-coefficient (r_s), and the Kolmogorov-Spirnov test.

The following chapter will contain the results of the statistical analysis gathered from the aforementioned data.

CHAPTER IV

FINDINGS, ANALYSIS, AND EVALUATION

4.1 Introduction

Nonparametric statistical procedures were used in the present research to ascertain the impact attitudes exert on certain intellective and nonintellective variables. The Spearman-rank, correlation-coefficient was used to measure the correlations of attitudes toward mathematics and each of the following:

1. Achievement in mathematics
2. Various personality characteristics
3. Anxiety toward mathematics

The Kolmogorov-Smirnov, two-sample test was employed to measure male-female attitudes toward mathematics. And, finally, a personal interview was conducted using an instrument designed by the researcher with those students whose scores on the Math Attitude Scale identified them as having negative attitudes toward mathematics. The personal interview was designed to allow the student to identify factors associated with negative attitudes toward mathematics.

At the beginning of the fall, 1978 semester, one-hundred-seventeen students were enrolled in the researchers four classes

in mathematics. Seventy-five students, which represented four percent of the total enrollment in classes in mathematics at Kennedy King City College, completed all instruments in the study. Sixty percent of the sample were female.

The students were told that they would be given several instruments and scales to complete at the beginning of the course. It was further stated that the scores on these instruments would in no way affect their grade. To further emphasize that fact, each student was assigned a number which was to be used instead of a name on all of the instruments. Special emphasis was placed on the fact that each person was expected to give his or her opinion with no thought of who would be reading the answers because only then would the responses be valid.

After the data was collected, there would be available a variety of scores for each student which would be used to determine some of the characteristics of a person who possesses negative attitudes toward mathematics. It is presumed that each null hypothesis will be rejected at $p < .05$.

The final phase of the research involved conducting a personal interview of those students whose scores on the two mathematics attitudinal scales indicated that they could be

classified as persons with negative attitudes toward mathematics. Fifty-one percent of the sample appeared to have negative attitudes toward mathematics. Eight of the thirty students were unable to complete the interview and of those who did, sixty-seven percent were women.

Persons identified by their scores on the attitudinal scales as having the most positive attitudes toward mathematics were used as interviewers. After one orientation meeting the interviewers were able to complete their task in approximately three weeks.

4.2 Male-Female Attitudes

To determine whether the attitudes toward mathematics of females and males differ the Kolmogorov-Smirnov, two-sample test was conducted. It is a nonparametric, one tailed test, designed to decide whether or not the values of the population from which one of the samples was drawn are stochastically larger than the values of the population from which the other sample was drawn.

The null hypothesis is that there is no difference in the attitude scores of males and females. The alternate hypothesis is that males have a more positive attitude toward mathematics than females.

Reference to Table 1 below which presents the cummulative frequency distribution of scores on the Math Attitude Scale shows that although sixty percent of the males made scores of seventy-four or above, only thirty-eight percent of the females obtained like scores.

TABLE 1

Cummulative Frequency Distribution of the Scores of Females and Males on the Math Attitude Scale

Scores	$S_{30}(X)$ (Males)	$S_{45}(Y)$ (Females)	$S_{30}(X) - S_{45}(Y)$
32-41	.0	.089	.089
42-49	.033	.089	.056
50-57	.067	.089	.022
58-65	.100	.111	.011
66-73	.200	.244	.044
74-81	.367	.022	.345
82-89	.167	.156	.011
90-100	.067	.020	.047

As predicted, the attitude toward mathematics of males was more positive than that of females, $\chi^2(75) = 8.57$, $p < .02$.

4.3 Attitudes an

As a test o is that community college students with negati toward mathematics are lower achievers in math those with positive attitudes toward mathematic man-rank, correlation-coefficient test was cor g the ranks of the scores on the Math Attitude he ranks of the scores on the numerical section o fornia Qualification Tests.

The null hyp that there is no difference in the achievement s sons with negative and positive attitudes towar . The alternate hypothesis is that persons wit titudes toward mathematics score lower on achieve mathematics than those with positive attitude hematics. The results of the Spearman-rank cor fficient were not statistically significant for ' le, $\underline{t}$ (75) = .9412, $\underline{p} < .05$; for the females, ' 0, $\underline{p} < .95$; nor for the males, $\underline{r}_s(30) = .217$, $\underline{p}$

4.4 Attitudes and

When the Spe correlation-coefficient was conducted using att mathematics and anxiety toward mathematics the co were highly statistically significant. As predict s with negative attitudes toward

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mathematics exhibited high degrees of anxiety toward mathematics, t (75) = 3.059, $p < .01$. Similar results were obtained for females of the sample, t (45) = 2.925, $p < .01$. However, no significant correlation existed for the males, $r_s(30) = .149$, $p < .05$.

A survey of the responses recorded by the persons identified as having the most negative attitudes shows that nineteen percent of the items on the Mathematics Anxiety Rating Scale received responses of "much" and "very much" in answer to the query "you are frightened by it nowadays." Table 2, which follows, gives the items and the percentages of the responses from the total sample, the males, and the females.

TABLE 2

Percentages of Items on the Mathematics Anxiety Rating Scale Receiving a Response of "Much" or "Very Much" From Persons With Negative Attitudes Toward Mathematics

Item	Male[a]	Female[b]	Total
Solving a problem such as: If x = 11, and y = 3, then the results of x/y is equal to ____?	10	50	37
Signing up for a math course.	10	45	33
Working on an income tax form.	60	50	53
Taking the math section of a college entrance exam.	20	55	43

	M	F	M/F
Reading and interpreting graphs or charts.	10	60	37
Reading a formula in Chemistry.	50	45	57
Hearing a lecture in a social science class where the instructor is commenting on some figures, e.g., the percentage of each socio-economic group who voted Republican.	30	45	40
Taking an examination (quiz) in a math course.	10	45	33
Taking an examination (final) in a math course.	30	45	40
Being given a homework assignment of many difficult problems which is due the next class meeting.	10	45	33
Thinking about an upcoming math test one day before.	20	45	37
Thinking about an upcoming math test one hour before.	50	45	47
Thinking about an upcoming math test five minutes before.	60	50	53
Waiting to get a math test returned in which you expected to do well.	20	50	40
Waiting to get a math test returned in which you expected to do poorly.	20	65	75
Realizing that you have to take a certain number of math classes to fulfill the requirements in your major.	20	55	43
Not knowing the formula needed to solve a particular problem.	10	45	33

	M	F	M/F
Receiving your final math grade in the mail.	30	50	43
Being given a "pop" quiz in a math class.	20	50	43

[a] $\underline{n}$ = 20.
[b] $\underline{n}$ = 10.

All ninety-eight items on the Mathematics Anxiety Rating Scale received a response of "much" or "very much" at least once from the thirty students identified as having the most negative attitudes toward mathematics. Although sixteen percent of the items did not receive that response from the males of this group, only the questions --

> Listening to a salesman show you how you would save money buying his higher priced product because it reduces long term expenses.
>
> and
>
> Reading a cash register receipt after your purchase. --

did not receive a "much" or "very much" response from the females of the group.

4.5 Attitude and Personality Characteristics

In order to determine whether or not community college students with negative attitudes toward mathematics possess personality characteristics different from those with positive attitudes toward mathematics the following null hypotheses

were tested using the Spearman-rank, correlation-coefficient:

1. H_o: There is no difference in personality characteristics of persons with positive and negative attitudes toward mathematics.

   H_1: Persons with negative attitudes toward mathematics will make lower scores on personality scales than persons with positive attitudes toward mathematics.

2. H_o: There is no difference in the dominance scores of persons with positive attitudes toward mathematics and those with negative attitudes toward mathematics.

   H_1: Persons with very positive attitudes toward mathematics will have high dominance scores and persons with negative attitudes toward mathematics will have low dominance scores.

3. H_o: There is no difference in the scores on the femininity scale of persons with positive attitudes toward mathematics and persons with negative attitudes toward mathematics.

   H_1: Persons with positive attitudes toward mathematics score low on the femininity scale and those with negative attitudes toward mathematics score high on the femininity scale.

Personality characteristics were divided into four sections on the California Psychological Inventory with each section measuring several characteristics. Correlations were tested with each section, labeled classes, and also with the single components of dominance and femininity.

Class I Personality Characteristics. Class I personality characteristics are dominance, capacity for status, sociability,

social presence, self-acceptance, and sense of well being. The results of the test indicated that as predicted, there were significant correlations between Class I personality characteristics and attitudes toward mathematics for the total sample, t (75) = 1.639, $p < .95$, and for the female members of the sample, t (45) = 2.083, $p < .05$. However, the males showed no statistically significant correlations, $r_s(30) = -.047$, $p < .05$.

Class II Personality Characterictics. Class II personality characteristics are responsibility, socialization, self-control, tolerance, good-impression, and communality. There was no statistical significance between Class II personality characteristics and attitudes toward mathematics for the total sample, t (75) = 1.398, $p < .05$, or for the male members of the sample, $r_s(30) = .071$, $p < .05$. However, as predicted, the female members of the sample with positive attitudes toward mathematics scored higher on Class II personality characteristics than those with negative attitudes toward mathematics, t (45) = 1.818, $p < .05$.

Class III Personality Characteristics. Class III personality characteristics are achievement via conformance, achievement via independence, and intellectual efficiency. No statistical significance was found between persons with positive attitudes

toward mathematics and those who scored high on Class III per-personality characteristics for the total sample, t (75) = 1.358, $p < .05$, or for the male members of the sample, r_s(30) = .046, $p < .05$. However, for the female members of the sample the results were as predicted, persons with positive attitudes toward mathematics were high scorers on Class III personality characteristics, t (45) = 1.608, $p < .05$.

Class IV Personality Characteristics. Class IV personality characteristics are psychological-mindedness, flexibility, and femininity. The results indicated that there was no significant correlation between persons with positive attitudes toward mathematics, and those who were high scorers in Class IV personality characteristics for the total sample, t (75) = .272, $p < .05$, for the males in the sample, r_s(30) = -.034, $p < .05$, nor for the females in the sample, t (45) = .2566, $p < .05$.

Dominance - A Personality Characteristic. The dominance scale was designed to assess factors or leadership ability, dominance, persistence, and social initiative. The results of correlation tests indicated that no statistically significant correlation existed between the attitudes toward mathematics and the personality characteristic dominance for the total sample, t (75) = .9025, $p < .05$, or for the females of the group,

$\underline{t}$ (45) = 1.0254, $\underline{p} < .05$. However, for the male members of the sample, the results were statistically significant with a negative correlation which indicates that a male with a positive attitude toward mathematics has low dominance characteristics, $\underline{r}_s(30) = -.317$, $\underline{p} < .05$.

Femininity - A Personality Characteristic. The femininity scale was designed to assess the masculinity or femininity of interests where high scores indicate more feminine interests and low scores indicate more masculine interests. No statistically significant correlations were found in the present study to indicate that the positive attitudes toward mathematics resulted in low femininity characteristics for the entire sample, $\underline{t}$ (75) = -1.465, $\underline{p} < .05$, for the male members of the sample, $\underline{r}_s(30) = .0211$, $\underline{p} < .05$, nor for the female members, $\underline{t}$ (45) = -1.0363, $\underline{p} < .05$.

Table 3 on page 74 displays the Spearman-rank, correlation-coefficients of attitudes toward mathematics and several personality characteristics: namely; Class I, Class II, Class III, Class IV, dominance, and femininity. Reference to Table 3 reveals that for the three groups --male, female, and the total sample-- five of the six categories yielded results that were statistically significant. It is also evident that the males of this research were predictable only sixteen percent of the time, whereas for females the percentage was one-half.

TABLE 3

Spearman-Rank Correlation-Coefficient of Attitudes Toward Mathematics and Several Personality Characteristics

Variable	Values of r_s	Value of t	
	Males[a]	Females[b]	Total Sample[c]
Class I	-.047	2.083*	1.639*
Class II	.071	1.818*	1.398**
Class III	.046	1.608*	1.358**
Class IV	-.034	.257	.273
Dominance	-.317*	1.025	.903
Femininity	.021	-1.036	-1.465**

[a] $n = 30$.

[b] $n = 45$.

[c] $N = 75$.

*$p < .05$.

**$p < .10$.

4.6 Personal Interviews

The personal interview form contained twenty questions. Thirteen of the qestions required a yes/no answer, five required answers to be written by the interviewer, and the final two questions requested that the responses be written by the interviewee. The results of these interviews are given in Tables 4, 5, 6, 7, 8, 9, and 10. In the tables that deal

with percentages, the total may not always be one hundred because all questions did not require answers from all interviewees.

TABLE 4

Percentages of Responses Given to Personal Interview Questions

Question	Female[a]		Male[b]	
	Yes	No	Yes	No
Did you like mathematics in high school?	55	45	60	40
Did you like mathematics in elementary school?	75	25	50	50
Do you remember when you first began to dislike mathematics?	45	5	20	30
Do you remember why it happened?	40	15	20	0
Did your mother like mathematics?	65	10	60	0
Did your father like mathematics?	55	20	30	10
Do you remember a mathematics teacher that you liked?	65	35	60	40
Do you remember a mathematics teacher that you did not like?	35	65	50	50
Was mathematics ever used as punishment in your class?	15	85	40	60
Do you want to like mathematics?	95	5	90	10

Do you think you would be better in mathematics if you liked it?	100	0	90	10
Do you have any children?	65	35	50	50
Do you try to help your children like mathematics?	50	15	40	10

[a] $n = 20$.
[b] $n = 10$.

Closer examination of Table 4 reveals that although 75% of females liked mathematics in elementary school only 55% continued to do so in high school. For males the trend was that more males enjoyed mathematics in high school than in elementary school.

Table 5 shows that females began to dislike mathematics in first, second, fifth, and sixth grades, and males began the dislike in third and fifth grades. The reasons given for a dislike of mathematics seem to indicate that mathematics itself is responsible, although three persons stated that the teachers' influence was to blame.

TABLE 5

Reasons Dislike for Mathematics First Began

Responses of Females[a]	Responses of Males[b]
Got confused when she had to do division.	Fifth grade. Would be punished if he couldn't do assigned math problems.

Just didn't like numbers.	Third grade. Didn't like teacher. She was mean.
Forced to take math.	
Slow in Algebra.	
First happened in fifth grade because she couldn't concentrate.	
In college. Hard to understand.	
Sixth grade. Bad teacher. Unable to get along with her way of teaching.	
Ever since she could remember.	
First or second grade. Teacher used to call on her and she would make excuses because she thought her answers would be wrong.	

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[a] $\underline{n} = 20$.

[b] $\underline{n} = 10$.

The word that appears repeatedly in Table 6 is "patience." Students appreciated and needed a teacher who exhibited the quality of patience. Of interest is the fact that many of the female students liked a male teacher the best as evinced by the use of the pronoun he. The fact that the teacher had good teaching methods was recognized by the students as helping in the understanding of mathematics. They also felt that a teacher who explained more and spent extra time with them were important factors.

TABLE 6

Reasons a Particular Teacher Was Liked

Responses of Females[a]	Responses of Males[b]
She would explain the basic steps and had more patience than others.	Teacher explained problems well and had a nice personality.
He explained things good.	More explanation, clearly stated.
He took time to show you what to do.	She took more than a normal interest in the students.
He was very tolerant.	The way she taught the subjects.
Good teaching methods.	
He would help me a lot.	
He was understanding and helpful when you did not know the problem.	
She explained and made it clear to understand.	
Her method of teaching was more understanding.	
She liked algebra.	
Assignments were not rushed through and time was taken with each student.	
Nice person, had a lot of patience with students.	
She explained and was patient.	

[a] $n = 20$.

[b] $n = 10$.

The responses listed in Table 7 seem to indicate that

personality played a key role in the effect teachers had on these students. They also stated in three cases that they did not like the way the teacher taught the class.

TABLE 7

Reasons a Particular Teacher Was Disliked

Responses of Females[a]	Responses of Males[b]
He didn't explain the course where it could be understood.	Didn't like the way they taught the class.
Didn't understand his method of teaching.	She was mean.
She did not take time to explain work detail by detail.	Class was not taught so student could be reached.
She talked to fast. Could hardly understand her.	Nasty personality.
Unable to get along with his way of teaching.	
Didn't take time with students.	

[a] $n = 20$.

[b] $n = 10$.

Another question asked was if mathematics was ever used as punishment in class. The responses were similar for both females and males. Three females responded with "not too often," "very often," and "several times." There were also

responses from three males, one of whom indicated "not too often," and the other two replied "often."

As seen in Table 8, when students were asked to rate mathematics on a scale from one to ten, no one thought the subject rated a score lower than five. It is interesting to note that seventy percent of the males and females gave mathematics a rating of eight or above. The top score was given fifty-five percent of the time by females, and only forty percent of the time by males.

TABLE 8

Percentages of Responses Rating the Importance of Mathematics in Everyday Living

Points*	Female[a]	Male[b]
1 to 4	0	0
5	10	30
6	10	0
7	10	0
8	10	20
9	5	10
10	55	40

*Highest rating is 10 points, lowest is 1 point.

[a] $\underline{n} = 20$.

[b] $\underline{n} = 10$.

Table 9 lists the responses students wrote to the question "What people or things to you think influenced your feelings or attitude toward mathematics?" All immediate family members were mentioned at least once. On nine occasions the teacher was given as the person exerting the most influence, including this researcher who was mentioned once. Friends also enter the sphere of influence where mathematics is concerned. The need for mathematics on jobs was mentioned, and the fact that "A lot of people have good jobs because of math."

TABLE 9

Persons or Things That Influenced Attitudes Toward Mathematics

Responses of Females[a]	Responses of Males[b]
My education and I really want to understand source of math.	Father, job, and future.
My brother.	Friends and myself.
Two math instructors - one in grammar school and one in high school.	A teacher and math is an important part of my occupation.
My family, money and handling money situations.	Don't think anyone influenced me.
None.	The way teachers express themselves when teaching.
Nursing.	The need for math.
Teachers in high school. Math is needed in everyday living.	A lot of people have good jobs because of math.
My major of physical therapist.	Nobody.

My mother and machines, etc.

Teacher.

My job.

When I see others getting very good grades in math.

The ways I learn seem different then the way it is being taught now.

Math teacher. My job is starting to deal with a lot of math.

People who won't reach someone. The importance of math in our everyday life, etc.

People very smart in math and don't give up easy while taking math.

My father and senior teacher in high school.

Mrs. Brown. My attitude has changed a lot since I've been in her class.

My sister.

A couple of my teachers, because of the way they approached it and left me completely ignorant or it.

The way some of my math teachers taught in high school sort of turned me off.

Persons going into medical fields.

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[a] $\underline{n} = 20.$

[b] $\underline{n} = 10.$

The final request of the persons taking part in the personal interview was that they write a sentence or two telling

as clearly and as fully as possible how they felt about mathematics. Table 10 lists the responses given to tnat statement. About twenty-seven percent of the sample stated that they just did not like mathematics. Approximately forty-seven percent of the sample used important, necessary, interesting, useful, stimulating, and essential to describe mathematics. Several felt that though it was important for their major or job, they just did not know enough about mathematics to understand it the the way they would like to.

TABLE 10

Personal Feelings About Mathematics

Responses of Females[a]	Responses of Males[b]
Personally I do not care for math simply because I do not understand the majority of it. I never did really. Someday, I hope to have the full understanding of it.	I feel that math can be fun and stimulating to the mind if there was a great interest in it by an individual. Sometimes when people are not motivated they cannot pretend that they enjoy math, therefore, they may not do so well.
I think math is important because you need it to count your money and things.	
During my high school days, I really disliked math. But now I realize how important it is to life and some of the professional careers I would really want to learn as much about it as possible.	I feel that math is very useful in life to everyone. It is more important to some people than others
I feel math is necessary and useful in everyday life. And	I really don't care to much for it, but its a help for what I'm training for.

also sometimes it is interesting once I understand the principle.

I don't like math at all. I think it is very unnecessary it is a waste of time to me. If I didn't need it I wouldn't take it.

Math is a subject interesting to me up to a point then I become less interested - but math also needed, on answers to many questions that can only be added in figures.

If I can get the hang of math I feel that math and I will get along very well.

I just don't like math in no way or form.

I feel very strongly about math because I have to have it for my nursing. I was never good in math, but I am trying very hard.

There are math problems I don't understand but usually will understand after hard work. Some math is easy for me. I like math and would like to be good at it.

The person make it seem clearly and get a feeling that can do better now than in the past.

I feel math is very interesting and something I am going to pursue. Even though I like math, it becomes hard and discouraging sometimes.

I really don't like math, if I didn't have to take it for my major I wouldn't take it.

I like math very much. It is that I had never been very good in it. But I am trying very hard.

I feel and know that math is a necessity for me, to complete my education.

I really don't care for math, but in the field I'm in requires a great deal of math.

Math seems to be very useful to me in my everyday living.

I have a solid interest in math and wish to master all forms of math and its applications. I feel that math offers a great range of possible interests.

I'm starting to like math, because it is a great part of my everyday living.

I feel that math is one of the most essential things a person should know.

I liked math, its very good to know especially for a business purpose. If the teacher is good then I would like it.

I like math because in the field I am going into math helps me to understand my job more clearly.

I don't like it because I don't understand it.

I would like math more if I could understand it. I haven't learned much math, just enough to get by.

I believe its important in everyday living. It can be confusing at times.

Math at first was just a word but since dealing with it, it has become a subject of building hopes, hopes of progress and understanding.

I would enjoy math more and more as it is explained to me because math isn't hard if one listens and understands it.

---

[a] $\underline{n} = 20$.

[b] $\underline{n} = 10$.

4.7 Analysis of Results

The present research was conducted with black, American students at an urban city college and most norms are established using white, middle-class Americans. Analysis of the data reflect similar trends in some cases and also what appear to be diametrically opposed results in others. The

results contained herein are not intended to be reflective of a representative sample, but merely a record of the trends of four percent of the people enrolled in four classes in mathematics in an urban, city college during the fall of 1978.

The similar trends occurred in the case of male and female attitudes toward mathematics, in the greater predictability of female correlations than those of males, in the highly statistically significant correlations obtained between attitudes toward mathematics and anxiety toward mathematics, and in the statistically significant correlations of various personality characteristics. At the opposite end of the spectrum are the statistically insignificant correlations of achievement in mathematics and attitudes toward mathematics, and the negative correlation for males of attitudes toward mathematics and the personality characteristic of dominance.

In the case of the attitudes of males and females toward mathematics, the results of previously mentioned studies were duplicated in the present research, because male attitudes toward mathematics tested more positive than those of female students. Previous research has also found that female responses are more predictable than those of males

and as can be seen in Table 11 on page 91, although four of the test results of females produced statistically significant results, only one test had similar results for the males of this study.

The most impressive correlations occurred with the test results of attitudes toward mathematics and anxiety toward mathematics. They indicated that there was a highly statistically significant correlation between negative attitudes toward mathematics and high feelings of anxiety toward mathematics for the females of the group.

All of the results of the correlations between attitudes toward mathematics and personality characteristics that yielded statistically significant correlations, except one, were for the females of the group. Closer examination of the characteristics in Class I indicate that high scorers tend to be seen as aggressive, confident, ambitious, active, outgoing, clever, intelligent, and energetic. For Class II, high scorers tend to be seen as planful, serious, honest, calm, enterprising, cooperative, and dependable. High scorers on Class III tend to be seen as capable, mature, and efficient. Because of the test results, it can be concluded than that the females in this study who have positive attitudes toward mathematics would possess many of the qualities listed above.

Low scorers on Class I characteristics tend to be seen as retiring, inhibited, apathetic, shy, awkward, moderate methodical, and unambitious. Low scorers on Class II characteristics tend to be seen as immature, moody, defensive, impulsive, suspicious, aloof, inhibited, and impatient. Low scorers on Class III characteristics tend to be seen as coarse, stubborn, anxious, and cautious. Therefore, the females of this study who possess negative attitudes toward mathematics can be said to possess more of the above characteristics than females with positive attitudes toward mathematics.

A basic assumption of this study was that there would exist a statistically significant correlation between attitudes toward mathematics and achievement in mathematics. This assumption did not emerge as a result of the testing for either the female or male members of the sample.

The one test that produced statistically significant results for males was the correlation of attitudes toward mathematics and dominance, a personality characteristic. This was also the most surprising because the result was an inverse correlation. A high scorer on the dominance scale tends to be seen as aggressive, confident, persuasive,

independnet, and as having leadership potential. A low scorer on the other hand tends to be seen as retiring, inhibited, indifferent, silent, and as lacking in self-confidence. The results of this research indicate that males who have negative attitudes toward mathematics scored high on the dominance scale, while those who had positive attitudes toward mathematics scored low on the same scale.

The present research was undertaken with the idea that all instruments would be completed within the first four weeks of the fall semester. This was not the case because a strike interrupted the semester after the first week of classes. When the semester resumed after a three and one-half week strike the attendance pattern of the students was more irregular than normally expected. Not only did a certain percentage not return to class after the strike, but many of those who did, attended classes sporadically. It is not known whether this fact affected the results, but the end of the semester was only two weeks away when the last personal interview was completed.

4.8 Summary

The present research tested the following hypotheses:

1. Community college students with negative attitudes toward mathematics are lower achievers than those with positive attitudes toward mathematics.

2. Community college students with negative attitudes toward mathematics possess unique mathematical anxieties.

3. Community college females possess a more negative attitude toward mathematics than do males.

4. Community college students with negative attitudes toward mathematics possess definite personality traits different from those with positive attitudes toward mathematics.

5. There are specific factors contributing to the acquisition of negative attitudes toward mathematics of community college students.

The sample included seventy-five black students from an urban, city college enrolled in four mathematics classes. The students completed seven instruments which were designed to measure attitudes toward mathematics, achievement in mathematics, anxiety toward mathematics, and several personality characteristics. In addition, those students with negative attitudes toward mathematics completed a personal interview designed to identify some of the factors involved in developing negative attitudes toward mathematics.

Nonparametric statistical tests were conducted on all data. The Kolmogorov-Smirnov test was used to determine whether or not female and male attitudes toward mathematics were different and the Spearman-rank, correlation-coefficient was used on all remaining data, except the personal interview information. The results of these statistical tests are given in Table 11.

TABLE 11

Correlations of Male/Female Attitudes Toward Mathematics and Attitudes Toward Mathematics With Achievement, Anxiety, and Personality Characteristics

Variables	Female[a]	Male[b]	Total[c]
Male/Female			8.57**
Achievement			
r_s		.217	
t	.390		.9412
Anxiety			
r_s		.149	
t	2.925*		3.059*
Class I			
r_s		-.047	
t	2.083***		1.639***
Class II			
r_s		.071	
t	1.818***		1.398
Class III			
r_s		.046	
t	1.608***		1.358
Class IV			
r_s		-.034	
t	.2566		.272
Dominance			
r_s		-.317***	
t	1.0254		.9025
Femininity			
r_s		.0211	
t	-1.0363		-1.465

[a]$\underline{n}$ = 45.

[b]$\underline{n}$ = 30.

[c]$\underline{N}$ = 75.

*$\underline{p} < .01$.

**$\underline{p} < .02$.

***$\underline{p} < .05$.

All members of the sample possessing negative attitudes toward mathematics as indicated by their scores on two mathematical attitude scales were given personal interviews. The responses to the interview questions yielded candid and personal insight into the thoughts and understandings as perceived by each interviewee as to what his or her feelings were toward mathematics and also why and how they had come about.

Chapter five will contain recommendations and conclusions based on the results of statistical analyses of all data.

5.3 Findings

The following pages will contain the findings of the present study based on the statistics resulting from the data gathered.

Achievement. The present study found no significant correlation between attitudes toward mathematics and achievement in mathematics. This is not contrary to results of previous studies which indicate that attitudes play a lesser role with lower achievers than with middle and high achievers. Aiken (1970) states that correlations between achievement in mathematics is higher for those in the middle range of attitudes than for those at the higher or lower end of the attitude continuum. The conclusions of Aiken (1972) and (1974), Jackson (1973), Sherman (1975), and Pearce (1976) all indicate that there is a significant positive correlation between attitudes toward mathematics and achievement in mathematics. Although most of the studies were conducted with white students, Jackson's population, like the present study, included black first year college students. Contrary to the above results, Neale (1969) and (1970), working with sixth graders, and Cristantiello (1962) whose study was with low, middle, and high neutral attitudes toward mathematics of two hundred sixty-four, white male college sophomores, reported no significant correlations between attitudes toward mathematics and achievement. Cristantiello (1962) went on to report that the

least indication of positive relations was with the low (or most negative) neutral group.

Anxiety. Another result of this study was that there was a highly statistically significant correlation between attitudes toward mathematics and anxiety toward mathematics. There is a limited amount of research on anxiety toward mathematics, however when Suinn (1973) standardized his instrument, the Mathematics Anxiety Rating Scale, on a university sample he found that specific mathematical anxieties do exist and reported a test-retest reliability of $r = .85$ and an internal consistence reliability of $r = .97$. Dreger and Aiken's (1957) research of seven-hundred-four basic, mathematics university students, reports that persons with high number anxiety tend to make lower mathematics grades which is inconsistent with the findings of the present study which found a high correlation between anxiety and attitude toward mathematics but no significant correlation between attitude and achievement in mathematics. Therefore, no significant correlation can exist between anxiety and achievement in mathematics.

Female/Male. When the attitudes toward mathematics of males and females were tested it was found that males had a more positive attitude than females which is not inconsistent with existing research. Poffenberger and Norton (1959) reported

that a study of three-hundred ninety, high school students, forty-eight percent of whom were female, indicated that there was a tendancy for men to like mathematics more than women.

Similar results were reported by Sherman (1975) and Kaminski (1976) whose studies of junior and senior high school students indicated that girls have a more negative attitude toward mathematics than boys for a variety of reasons including societal pressures. Aiken (1976) in his review of research conducted during the first five years of the seventies concludes that studies have found that differences in attitudes in mathematics frequently favor boys over girls at the junior high level and beyond. However, Roberts' (1969) study of two-hundred sixty-four college students from four-year and two-year institutions and Pearce's (1976) research of two-hundred eighty-two black or white freshman community college students yielded no significant difference in attitude toward mathematics with respect to sex.

Personality. Several factors of personality emerged when significant correlations were recorded from the scores of females on the California Psychological Inventory. The characteristics that females with negative attitudes toward

mathematics would tend to possess according to the results of this study are as follows: retiring, inhibited, apathetic, shy, awkward, methodical, unambitious, immature, moody, defensive, impulsive, suspicious, aloof, impatient, coarse, stubborn, anxious, and cautious. This is consistent with the findings of Aiken (1963) on women college sophomores, (1972) on college freshmen, (1974) on male or female college sophomores, and Johnson (1971) on university students when they reported that persons who possessed positive attitudes toward mathematics exhibited personality characteristics completely opposite from those listed above. The results for the men of the present study produced no significant correlations.

Dominance. Dominance was the single personality characteristic that produced a significant correlation with attitudes toward mathematics for males. Test results indicated that there was an inverse correlation between the two so that it must be concluded that the males of the present study who possess negative attitudes toward mathematics will have dominant personalities and will tend to be seen as aggressive, confident, persuasive, independent, and exhibiting leadership potential. The results for the women produced no significant correlations.

Femininity. The results of the tests conducted were not significant at conventional levels of confidence, however, inferences can be made from the fact that the negative coefficient for the total group and for the females of the sample indicate an inverse correlation. This means that persons with negative attitudes toward mathematics displayed a high degree of feminine interests. This is contrary to the results reported by Lambert (1960) who found that female majors of mathematics were more feminine than others. Correlations of data for males rendered inconclusive results.

Personal Interviews. The results of personal interviews conducted with students possessing negative attitudes toward mathematics can be separated into two groups. One group of responses were to the fifty percent of the questions on which there is little or no previous research available.

Those findings indicated that females liked mathematics better in elementary school than in high school, although the feelings of males was the opposite. Another result of the present study was that only fifteen percent of the females remembered instances where mathematics was used as punishment whereas forty percent of the males remembered; however in each case the occurrence was not very often. Nearly all of the students wanted to like mathematics better because then they

believed they would be more successful. Of those students who had children, fifty percent of the females and forty percent of the males said they try to help their children like mathematics. And seventy percent of the students rated mathematics as important in every day living.

When students were asked to state how they felt toward mathematics the findings were that twenty-five percent of the female and twenty percent of the male interviewees expressed a dislike for mathematics because it was not understandable and was unnecessary, and that they were enrolled in the class only because it was required for their major. Twenty-five percent of the females and forty percent of the males used the words important, useful, necessary, very good to know, essential, or interesting to describe mathematics. Others used the words hard, discouraging, and confusing.

Many expressed a liking for mathematics and a desire for greater understanding of it in order to do better in the subject. Twenty-five percent of the females and thirty percent of the males wrote that mathematics was held high because of career or education requirements.

The remaining fifty percent of the interview questions produced similar results to what has been found in existing

research. The present study found that students first began to dislike mathematics in the first, second, third, fifth, or sixth grades which is consistent with the reports of Poffenberger and Norton (1959) and Knaupp (1973). Some reasons given for the dislike were confusion with division, lack of concentration, fear of being punished, and bad teaching. Although determining the influence of parents on the attitudes of the students is beyond the scope of the present study sixty-five percent of the females and sixty percent of the males indicated that their mother liked mathematics while only fifty-five percent of the females and thirty percent of the males remembered their father liking mathematics. Poffenberger and Norton (1959) also reported that only twenty-five percent of the dislike group reported that their fathers liked mathematics.

Sixty-five percent of the female students and sixty percent of the male students remembered a mathematics teacher, whom they liked and the reasons given were that these teachers explained the basic steps, took time with students, and were very understanding. Thirty-five percent of the females and fifty percent of the males could remember a teacher they did not like and the reasons for that dislike were that the teacher did not explain, could not be understood, had an unpleasant

personality, and did not take time with students. The foregoing is certainly consistent with the findings of Dutton (1951), Poffenberger and Norton (1956) and (1959), Tulock (1957), Jackson (1973), and Aiken (1972) and (1976), each of whom conducted research on the role of the teacher in attitude formation.

The sphere of influence in present attitudes toward mathematics included family members, twenty percent of the time, job and everyday living situations, thirty-seven percent of the time, and friends, one percent of the time. Teachers and education were mentioned no less than forty percent of the time by the total group being interviewed, forty-five percent of the females and thirty-three percent of the males, as the strongest influence. All of the aforementioned researchers' findings were similar to those mentioned with reference to teacher's influence. This seems to make the studies conducted by Dutton (1951), Reys (1968), and Johnson (1976), to name a few, on the attitudes of teachers and perspective teachers toward mathematics worthy of special note, because the results indicated that a high percentage of those queried hated and/or feared mathematics and thought of it as awful, unpleasant, or bad.

5.4 Conclusions

These conclusions are based on a study conducted with four

percent of the students enrolled in classes in mathematics at an urban, predominantly black community college.

Specific. Significant correlations were obtained for three of the four hypotheses statistically tested. It can be concluded that:

1. Community college students with negative attitudes toward mathematics do possess unique anxieties toward mathematics.
2. Community college females do possess more negative attitudes toward mathematics than do males.
3. Community college females, more so than males, do possess definite personality characteristics.

With respect to attitudes toward mathematics and achievement, it would appear from the results of the present study that negative attitudes do not influence achievement.

Further conclusions, based on personal interviews, imply that there are very definitely specific factors contributing to the acquisition of negative attitudes toward mathematics in community college students.

General. Persons with negative attitudes toward mathematics do possess unique characteristics, some of which are instrumental in their approach to education and the pressures of daily existence. It appears that attitudes are important determinants in the acquisition of knowledge, however, for students considered low achievers the correlations were not as high as the conventionally accepted percentages.

The single most important variable seen by the students themselves as affecting their performance was the effect of the teacher, and therefore, close scrutiny should be given to the attitudes of teachers and the curricula of teacher-training institutions.

5.5 Recommendations

For Immediate Action. The largest single factor affecting attitudes toward mathematics according to forty percent of those interviewed was the influence of the teacher. Teachers should be made aware of the impact of their actions and the resultant transferance of attitudes for which they are directly and indirectly responsible for in their students. This can be accomplished through in-service training programs conducted nationally throughout the educational system for both elementary and high school teachers.

The programs which can be conducted in three phases might include the following:

1. Make teachers aware of their own attitudes toward mathematics.
2. Make teachers aware of the impact their attitudes have on the people they are teaching.
3. Encourage and aid teachers in improving their attitudes toward mathematics.

For Long Range Action. Those persons responsible for

training teachers should begin to include in the curricula for all perspective teachers required courses dealing with attitudes toward subject matter courses. Perspective teachers should be cognizant of their own attitudes toward the subjects they plan to teach. Teacher-training institutions must begin to take the iniative in improving current curricula in order to combat apparent short comings.

For Further Research. There are several aspects of negative attitudes toward mathematics which became apparent as a result of the present research. Studies conducted with community college students as subjects are few and far between. Additional studies are needed on the effect of attitudes of low achievers on the acquisition of knowledge.

The curricula of teacher-training institutions needs to be examined for relevance in content and design as it attempts to prepare teachers to meet the current and future needs of students.

Research can also be conducted on the effects of and need for appraisals of the impact of attitudes of teachers on their students in subject matter areas and the possible need for improvement of same.

Similar studies might be conducted with students over

a two semester time period to avoid the pressures encountered because of attendance patterns of community college students.

APPENDICIES

APPENDIX A - QUESTIONNAIRES

APPENDIX A1 - Biodata Information

NUMBER_____

BIODATA INFORMATION

PLEASE ANSWER THE FOLLOWING QUESTIONS

1. What is your age? _____

2. How many math classes did you take in high school? _____

3. Write the name of each math class you had in high school:

_____ _____ _____

ATTN: Answer either Number 4 or Number 5

4. What year did you graduate from high school? _____

5. What year did you earn your GED? _____

6. Is this the first math class you have taken at Kennedy King?

_____
yes or no

7. If not, list any other math class you have taken and the final grade you received:

_____ _____

_____

8. Do you plan to take other math classes at Kennedy King?

_____
yes or no

9. Are you married or single? _____

10. How many children do you have? _____

APPENDIX A2 - Personal Interview Questions

NUMBER_____

PERSONAL INTERVIEW QUESTIONS

1. Did you like mathematics in high school? _____
2. Did you like mathematics in elementary school? _____
3. (If no to No. 1 or No. 2) Do you remember when you first began to dislike mathematics? _____
4. (If yes to No. 3) Do you remember why it happened? _____
5. (If yes to No. 4) Why did it happen? _____

   _____
6. Did your mother like mathematics? _____
7. Did your father like mathematics? _____
8. Do you remember a mathematics teacher that you liked? ___
9. (If yes to No. 8) Do you remember why you liked that par-particular teacher? _____

   _____
10. Do you remember a mathematics teacher that you did not like? _____
11. (If yes to No. 10) Do you remember why you did not like that particular teacher? _____

    _____

12. Was mathematics ever used as punishment in your class? _____

13. (If yes to No. 12) How often did it happen? _____

14. Do you want to like mathematics? _____

15. Do you think you would be better in mathematics if you liked it? _____

16. Do you have any children? _____

17. (If yes to No. 16) Do you try to help your children like mathematics? _____

18. Using a scale of 1 to 10, where 10 is the highest possible score and 1 is the lowest, how would you rate the following statement: Mathematics is important in everyday living.

_____

19. What people or things do you think influenced your feeling or attitude toward mathematics? _____

_____

_____

20. Write a sentence or two telling as clearly and as fully as possible how you feel about mathematics. _____

_____

_____

APPENDIX B - STATISTICAL FORMULAE

APPENDIX B1 - Spearman-Rank Correlation-Coefficient: r_s

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N}$$

where d_i = the difference between the two ranks

In large samples the significance of an obtained r_s under the null hypotheses may be tested by:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}}$$

APPENDIX B2 - Kolmogorov-Smirnov Two-Sample Test

$$\chi^2 = 4D^2 \frac{n_1 n_2}{n_1 + n_2}$$

where $D = \text{maximum} \left[S_{n_1}(X) - S_{n_2}(X) \right]$

APPENDIX C - STATISTICAL ANALYSIS

APPENDIX C1 - Male/Female Math Attitudes

H_o: $E(X) \leqslant E(Y)$. The math attitudes are the same.

H_o: $E(X) > E(Y)$. Male attitudes are more positive.

Cumulative Frequency Distribution of the MAS Scores

	32-41	42-49	50-57	58-65	66-73	74-81	82-89	90-100
$S_{30}(X)^a$	0/30	1/30	2/30	3/30	6/30	11/30	5/30	2/30
$S_{45}(Y)^b$	4/45	4/45	4/45	5/45	11/45	1/45	7/45	9/45

[a]Males

[b]Females

D = .345

$$\chi^2 = 4D^2 \frac{n_1 n_2}{n_1 + n_2} = 4(.345)^2 \frac{(30)(45)}{30 + 45} = 8.57$$

The critical value for χ^2 at df = 2 is 7.82 at $\alpha = .02$ and since $8.57 > 7.82$ reject H_o.

APPENDIX C2 - Attitudes/Achievement

1. Total Group

$N = 75$ $\quad\quad \sum d_i^2 = 62,600$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(62600)}{75^3 - 75} = .1095$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .1095 \sqrt{\frac{75 - 2}{1 - .1095}} = .9412$$

The critical value for t at $\alpha = .05$ is 1.666 and since $.9412 < 1.666$, reserve judgement on H_o.

2. Females

$N = 45$ $\quad\quad \sum d_i^2 = 14,280$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(14280)}{45^3 - 45} = .0593$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .0593 \sqrt{\frac{45 - 2}{1 - .0593}} = .3895$$

The critical value for t at $\alpha = .05$ is 1.682 and since $.3895 < 1.682$, reserve judgement on H_o.

3. Males

$N = 30$ $\quad\quad \sum d_i^2 = 3,519.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(3519.5)}{30^3 - 30} = .2170$$

The critical value of r_s at $\alpha = .05$ is .306 and since $.217 < .306$, reserve judgement on H_o.

APPENDIX C3 - Attitudes/Anxiety

1. Total Group

$N = 75$ $\sum d_i^2 = 46,601.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(46601.5)}{75^3 - 75} = .3371$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .3371 \sqrt{\frac{75 - 2}{1 - .3371^2}} = 3.059$$

The critical value for t at $\alpha = .01$ is 2.385 and since $3.059 > 2.385$, reject H_o.

2. Females

$N = 45$ $\sum d_i^2 = 8996$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(8996)}{75^3 - 75} = .4074$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .4074 \sqrt{\frac{45 - 2}{1 - .4074^2}} = 2.925$$

The critical value for t at $\alpha = .01$ is 1.994 and since $2.925 > 1.994$, reject H_o.

3. Males

$N = 30 \qquad \sum d_i^2 = 3823.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(3823.5)}{30^3 - 30} = .149$$

The critical value for r_s at $\alpha = .05$ is .306 and since $.149 < .306$, reserve judgement on H_o.

APPENDIX C4 - Attitudes/Class I

1. Total Group

$N = 75 \qquad \sum d_i^2 = 57,052.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(57052.5)}{75^3 - 75} = .1884$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .1884 \sqrt{\frac{75 - 2}{1 - .1884^2}} = 1.639$$

The critical value for t at $\alpha = .05$ is 1.666 and since $1.639 < 1.666$, reserve judgement on H_o.

(NOTE: Critical value for t at $\alpha = .10$ is 1.2933.)

2. Females

$N = 45 \qquad \sum d_i^2 = 10,583$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(10583)}{45^3 - 45} = .3028$$

Since $N > 30$, compute t score:

$$t = r_s\sqrt{\frac{N-2}{1-r_s^2}} = .3028\sqrt{\frac{45-2}{1-.3028^2}} = 2.0834$$

The critical value for t at $\alpha = .05$ is 1.682 and since $2.083 > 1.682$, reject H_o.

3. Males

$N = 30$ $\qquad \sum d_i^2 = 4704.25$

$$r_s = 1 - \frac{6\sum d_i^2}{N^3 - N} = 1 - \frac{6(4704.25)}{30^3 - 30} = -.047$$

The critical value for r_s at $N = 30$ for $\alpha = .05$ is .306 and since $-.047 \not< -.306$, reserve judgement on H_o.

APPENDIX C5 - Attitudes/Class II

1. Total Group

$N = 75$ $\qquad \sum d_i^2 = 58,718$

$$r_s = 1 - \frac{6\sum d_i^2}{N^3 - N} = 1 - \frac{6(58718)}{75^3 - 75} = .165$$

Since $N > 30$, compute t score:

$$t = r_s\sqrt{\frac{N-2}{1-r_s^2}} = .165\sqrt{\frac{75-2}{1-.165^2}} = 1.398$$

The critical value for t at $\alpha = .05$ is 1.666 and since $1.398 < 1.666$, reserve judgement on H_o.

(NOTE: Critical value for t at $\alpha = .10$ is 1.293.)

2. Females

$N = 45$ $\quad \sum d_i^2 = 11{,}123.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(11123.5)}{45^3 - 45} = .267$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .267 \sqrt{\frac{45 - 2}{1 - 267^2}} = 1.818$$

The critical value for t at $\alpha = .05$ is 1.682 and since $1.818 > 1.682$, reject H_o.

3. Males

$N = 30$ $\quad \sum d_i^2 = 4418$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(4418)}{30^3 - 30} = .071$$

The critical value for r_s at $\alpha = .05$ is .306 and since $.071 < .306$, reserve judgement on H_o.

APPENDIX C6 - Attitudes/Class III

1. Total Group

$N = 75$ $\quad \sum d_i^2 = 59{,}265.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(59265.5)}{75^3 - 75} = .157$$

Since $N > 30$, compute t score:

$$t = r_s\sqrt{\frac{N-2}{1-r_s^2}} = .157\sqrt{\frac{75-2}{1-.157^2}} = 1.358$$

The critical value of t for $\alpha = .05$ is 1.666 and since $1.358 < 1.666$, reserve judgement on H_o.

(NOTE: Critical value of t for $\alpha = .10$ is 1.293.)

2. Females

$N = 45$ $\qquad \sum d_i^2 = 11,563.5$

$$r_s = 1 - \frac{6\sum d_i^2}{N^3 - N} = 1 - \frac{6(11563.5)}{45^3 - 45} = .238$$

Since $N > 30$, compute t score:

$$t = r_s\sqrt{\frac{N-2}{1-r_s^2}} = .238\sqrt{\frac{45-2}{1-.238^2}} = 1.688$$

The critical value of t for $\alpha = .05$ is 1.682 and since $1.688 > 1.682$, reject H_o.

3. Males

$N = 30$ $\qquad \sum d_i^2 = 4,288$

$$r_s = 1 - \frac{6\sum d_i^2}{N^3 - N} = 1 - \frac{6(4288)}{30^3 - 30} = .046$$

The critical value of r_s at $\alpha = .05$ is .308 and since $.046 < .308$, reserve judgement on H_o.

APPENDIX C7 - Attitudes/Class IV

1. Total Group

$N = 75$ $\quad\quad$ $\sum d_i^2 = 68,054$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(68054)}{75^3 - 75} = .0319$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .0319 \sqrt{\frac{75 - 2}{1 - .0319^2}} = .2727$$

The critical value of t for $\alpha = .05$ is 1.666 and since $.2727 < 1.666$, reserve judgement on H_o.

2. Females

$N = 45$ $\quad\quad$ $\sum d_i^2 = 14,586$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(14586)}{45^3 - 45} = .0391$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .0391 \sqrt{\frac{45 - 2}{1 - .0391^2}} = .2566$$

The critical value of t at $\alpha = .05$ is 1.682 and since $.2566 < 1.682$, reserve judgement on H_o.

3. Males

$N = 30$ $\quad\quad$ $\sum d_i^2 = 4,646$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(4646)}{30^3 - 30} = -.034$$

The critical value of r_s for $\alpha = .05$ is .306 and since $-.034 < -.306$, reserve judgement on H_o.

APPENDIX C8 - Attitudes/Dominance

1. Total Group

$N = 75$ $\qquad \sum d_i^2 = 62,915.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(62915.5)}{75^3 - 75} = .105$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .105 \sqrt{\frac{75 - 2}{1 - .105^2}} = .9025$$

The critical value of t at $\alpha = .05$ is 1.666 and since $.9025 < 1.666$, reserve judgement on H_o.

2. Females

$N = 45$ $\qquad \sum d_i^2 = 12,835$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(12835)}{45^3 - 45} = .1545$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = .1545 \sqrt{\frac{45 - 2}{1 - .1545^2}} = 1.025$$

The critical value of t at $\alpha = .05$ is 1.666 and since $1.025 < 1.666$, reserve judgement on H_o.

3. Males

$N = 30$ $\quad\quad \sum d_i^2 = 5{,}921.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(5921.5)}{30^3 - 30} = -.317$$

The critical value of r_s at $\alpha = .05$ is .306 and since $-.317 < -.306$, reject H_o.

APPENDIX C9 - Attitudes/Femininity

1. Total Group

$N = 75$ $\quad\quad \sum d_i^2 = 82{,}190.5$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(82190.5)}{75^3 - 75} = -.169$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = -.169 \sqrt{\frac{75 - 2}{1 - (-.169)^2}} = -1.465$$

The critical value of t at $\alpha = .05$ is 1.666 and since $-1.465 > -1.666$, reserve judgement on H_o.

(NOTE: Critical value of t at $\alpha = .10$ is 1.293.)

2. Females

$N = 45$ $\quad\quad \sum d_i^2 = 17{,}550$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(17550)}{45^3 - 45} = -.156$$

Since $N > 30$, compute t score:

$$t = r_s \sqrt{\frac{N - 2}{1 - r_s^2}} = -.156 \sqrt{\frac{45 - 2}{1 - (-.156)^2}} = -1.036$$

The critical value of t for $\alpha = .05$ is 1.682 and since $-1.036 \not< -1.682$, reserve judgement on H_o.

3. Males

$N = 30$ $\qquad \sum d_i^2 = 4,400$

$$r_s = 1 - \frac{6 \sum d_i^2}{N^3 - N} = 1 - \frac{6(4400)}{30^3 - 30} = .021$$

The critical value of r_s at $\alpha = .05$ is .306 and since $.021 < .306$, reserve judgement on H_o.

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